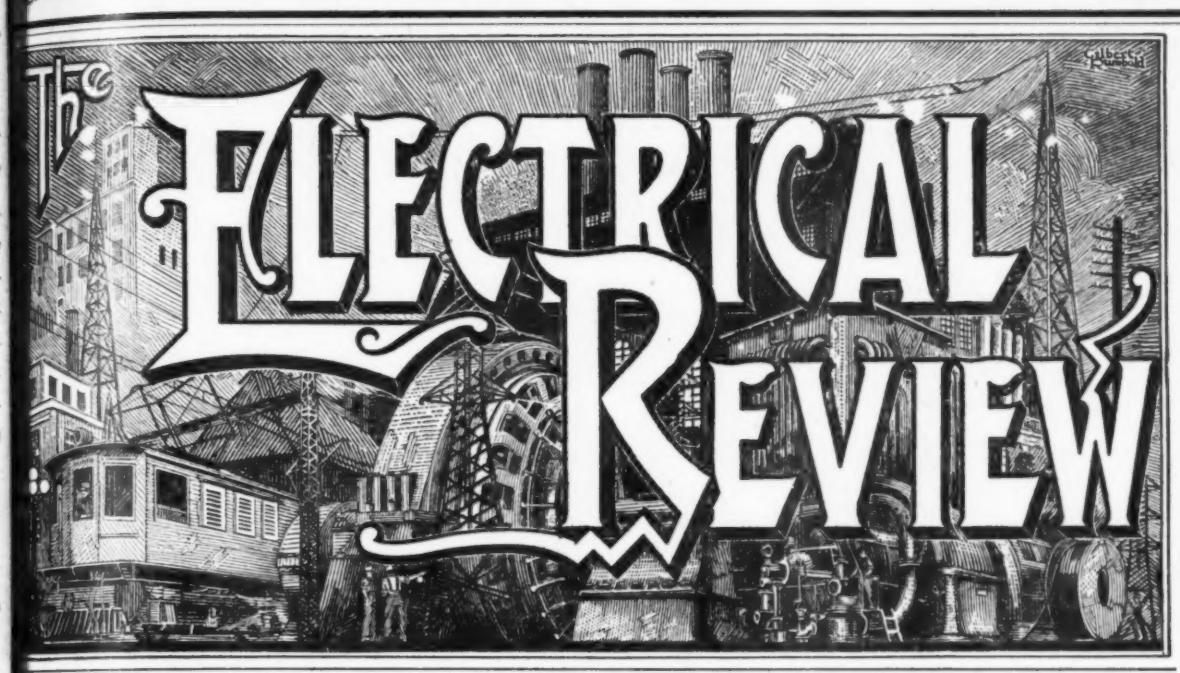
DEC 6 1923



VOL. XCIII. No. 2400. [All Rights Reserved.] NOVEMBER 23, 1923. [Registered at G.P.O. as a Newspaper and Canadian Magazine rate of postage.] PRICE SIXPENCE.

LITHOLITE INSULATORS, Ltd.
55—57, Hackney Grove, London, E. 8.
'Phone and Telegrams: Dalston, 592, London.
FIREPROOF AND OTHER GRADES.
WIRELESS MOULDINGS.

ELECTRIC INSULATION
NON-HYGROSCOPIC.
FIREPROOF.
SILUMINITE
...KET
...OULDINGS.
...E SILUMINITE
...NSULATOR Co., Ltd.,
...n Green, Southall, Middlesex.
'Phone—Southall 59.

FERGUSON, PAILIN, Ltd.
SPECIALISTS IN
SWITCHGEAR.
...IGHER OPENSHAW, MANCHESTER.
...ne: OPENSHAW, 329. 'Grams: TENSION, MANCHESTER.

INSTRUMENTS, CIRCUIT-BREAKERS,
AUTO-CUT-IN & CUT-OUTS
Record Electrical Co., Ltd.,
BROADHEATH, MANCHESTER.
TELEPHONE: 164 ALTRINCHAM.

"HEATRAE" Registered.
...LECTRIC FIRES, Ltd., NORWICH.
See Page iii, next week.

SWITCHGEAR.
...ERNEST F. MOY, LTD.,
Manufacturing Electrical Engineers and Government Contractors.
...REENLAND PLACE, CAMDEN TOWN, LONDON

"CANTIE"
IRONCLAD SWITCHBOARDS
CHEAP, EFFICIENT, ROBUST.
...CANTIE SWITCH CO., LTD.,
...EIGHTON ST. NOTTINGHAM.

SAXONIA EST. 1895.
...ELECTRICAL WIRE CO., LTD.
GREENWICH, S.E. 10.
...XTRA FLEXIBLE CABLES AND CORDS.
DYNAMO AND TRAILING LEADS.
AERIALS FOR WIRELESS.

CHURTON
SINGLE and POLYPHASE
MOTORS.
T. HARDING CHURTON & CO., LTD.,
Atlas Works, Water Lane, LEEDS.

Cutting
Electric Motors.
CUTTING BROS., LTD., STAMFORD.
Telegrams: Cutting, Stamford. Tel. No. 13.

"EMPIRE"
AUTOMATIC CONTROL
for
PUMPS, COMPRESSORS, MACHINE TOOLS
ELECTRIC CONTROL, LTD., GLASGOW.
Birmingham, Leeds, London, Manchester.

WESTERN-ELECTRIC
COMPANY, LIMITED,
Connaught House, Aldwych, W.C. 2.
Works: NORTH WOOLWICH, LONDON, E.
TELEPHONES & CABLES.
See Advertisement this week, p. xvi.

SELF-WINDING WORKSHOP REELS,
for Light or Power Flexes.
WAYNE ENGINEERING & EQUIPMENT CO., LTD.,
18, SAVOY STREET, STRAND, W.C. 2.

"L.W." DYNAMOS & MOTORS.
Manufactured by
TODMAN, RYALL & Co., Ltd.,
Head Office:—38, Grosvenor Gardens,
LONDON, S.W. 1.

E. DAWSON & CO.,
LAMPS (AS USUAL).
In addition
Wireless Valves, Crystal and Valve Receiving Sets, Head 'Phones, &c.
10, Gray's Inn Road, London, W.C. 1.
(Phone: Holborn 2794.)

JULIUS SAX
Specialists in
BELLS
and
Wall Plugs.
ESTABLISHED 1855.

The Latest Wiring Catalogue.
See Sup. 8

MOTORS
BY
McClure & Whitfield,
Small Power Dynamo Co., Ltd.
Agents
CITY ELECTRICAL CO., 1, Emerald Street, LONDON, W.C. 1.

FULLER'S UNITED ELECTRIC WORKS, LIMITED.
MANUFACTURERS OF
ACCUMULATORS BATTERIES
WIRES & CABLES EBONITE
WIRELESS APPARATUS CARBON BLACK
Head Office:
(General Sales Offices and Works).
WOODLAND WORKS, GROVE ROAD,
CHADWELL HEATH, ESSEX.

MAVOR & COULSON, Ltd.,
GLASGOW.
MOTORS, DYNAMOS, SWITCHGEAR.

ALUMINIUM—STEEL
FOR
LONG-SPAN TRANSMISSION.
The British Aluminium Co., Ltd.,
109, Queen Victoria St., London.

BIRKBY'S
"ELO" INSULATION
MOULDINGS, MOULDING POWDER & VARNISH.
Resists Heat, Fire, Acid Fumes, Solvents, live steam, weather, and is of great dielectric and mechanical strength.
FLEMING, BIRKBY & GOODALL, Ltd., Liversedge, Yorks.

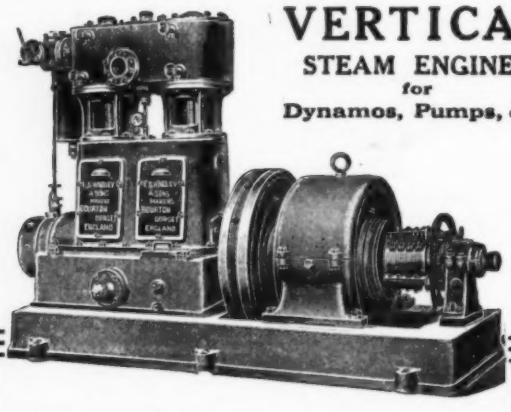
THE LEA COAL METER
keeps a complete check upon your coal consumption. It is a continuous, automatic and reliable machine for measuring your coal, just as it is burned.
The LEA RECORDER CO., Ltd., 28, Deansgate, MANCHESTER.

The number of square people, not the number of square miles, makes a country great.
M.E.M.
See p. xi.

Advertisement Index, see page xliv. *Official Notices, see Sup. 42.*

Hindley

VERTICAL
STEAM ENGINES
for
Dynamos, Pumps, &c.



Hindley Vertical Steam Engines are the outcome of many years' experience, and for all services where reliability is of paramount importance, are unexcelled.

The following are distinctive features :—

Robust Construction. Governor enclosed in crank case. Forced lubrication with neat oil pressure regulation. Patent Duplex Reversible Strainer, cleaned whilst running. Large doors at front and back of crank case, making parts very accessible.

Sets up to 20 KW. can be despatched from stock with direct-coupled dynamos for 110 volts.

For larger units we quote early deliveries.

Send enquiries to :

E. S. HINDLEY & SONS,
11, QUEEN VICTORIA STREET, LONDON, E.C.4.
Works :—BOURTON, DORSET.
Telegrams: "Steamport, Cannon, London." Telephone: City 9984.
Makers of Hindley { *Vertical Gas Engines.* / *Vertical and Colonial Steam Boilers.*

OUR
MOULDED INSULATORS
WILL
NOT MELT NOR **CRACK**
AT **300° F.**

USE—
"Belleroid" for Electrical Insulation and Low-Heat Conductivity.
"Bellerite" for Mechanical Goods and Low-Heat Conductivity.
"Bellerocks" Opaque to X-Rays.

INSULATORS FOR
WIRELESS RECEIVING SET
A SPECIALITY.
All British Made.

For Further Particulars and Prices apply to—

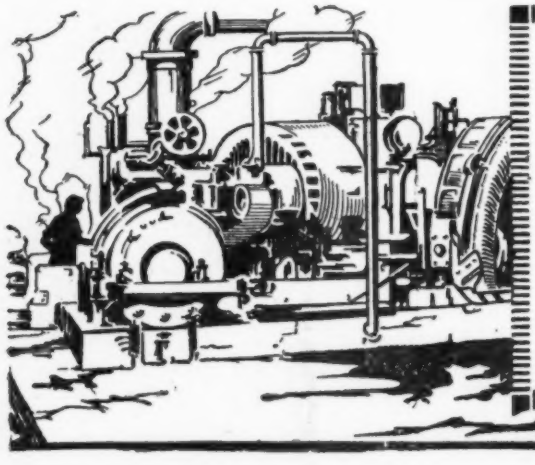
BARRETT & ELERS, LTD
Wallis Road,
HACKNEY WICK, E.9.
Telephone: 887 EAST.
London Sales Agents :—
HARWELL, Ltd., 28, John St., Theobalds Road, W.C.

MICA & MICANITE

'PHONE—4575 CENTRAL.
TELEGRAMS—"MICAYLOR, LONDON."

INSULATORS FOR EVERY DESCRIPTION OF ELECTRICAL WORK.
Contractors for Air Board, War Office and Admiralty requirements.
CUTTING AND GAUGING OUR SPECIALITY.
BEST QUALITY MICA ONLY.

TAYLOR & PETTERS, LTD.,
40, HATTON GARDEN,
LONDON, E.C.1.
(The Oldest Established Mica House in the country.)
AND ALL BRITISH.



We are the Largest
Buyers of Non-Ferrous
SCRAP METAL
and are always open for
SCRAP BRASS, GUN METAL, COPPER,
TURNINGS & BORINGS ETC. ETC.

H. B. BARNARD & SONS
GLYN STREET : VAUXHALL : LONDON S.E.11
Telephone: HOP 4520.
Telegrams: "METALCIBLES" LONDON.

RESISTANCES.

If it's a Resistance you want,
——Remember that Austin Walters & Son make it.
AUSTIN WALTERS & SON Gaythorn Electric Works, MANCHESTER.

THE

ELECTRICAL REVIEW.

VOL. XCIII. NOVEMBER 28, 1923. No. 2,400.

ELECTRICAL REVIEW.

Vol. XCIII.] CONTENTS: November 23rd, 1923. [No. 2,400.

	Page
Keeping the Electrical Flag Flying	761
The Wireless Exhibition	762
Mercury and Other Turbines	762
Globular Lightning	763
Trade Journals and Empire Trade	763
Medals for Meddlers	763
The Settlement of the Boilermakers' Dispute...	763
Electricity in Mining	764
Repairing Broken Electrodes, by "Lapis Lazuli"	765
The All-British Wireless Exhibition.—II. (*illus.*)	766
The Electrical Trades Benevolent Institution	768
Notes from Canada...	768
The Sale of "Heat"	769
New Electrical Devices, Fittings, and Plant (*illus.*)	770
Parliamentary Notes	770
Cheaper Cables for Rural Electricity Distribution, by A. Hugh Seabrook	771
Legal	771
Correspondence—	
Diesel-Electric Propulsion.—"Price Reductions?"—The Cost of Living in India.—Electric Cranes	773
Telephone Licence.—Wiring for "Wireless."—"Strictly Home Office".—"Electric Light" or "Electricity."—The Design of Tramcars	774
Ball Lightning	775
The Postmaster-General and Electrical Power and Lighting Undertakings	775
Business Notes	776
Notes...	784
City Notes	787
Stocks and Shares	787
Accurate Metering, by S. H. Richards (*concluded*)	789
Russian Electrical Notes	791
Electrical Opportunities in Northern Africa	792
The New Regulations for Overhead Lines	793
On Thunderbolts, by W. M. Thornton	794
Exports and Imports of Electrical Goods and Machinery in October, 1923	795
Binard-Fluid Turbines (*illus.*)	796
Telephotography and Television without Wires	797
British Electrical and Allied Manufacturers' Association ...	798
Developments in Illuminating Engineering	799
New Patents	799
Published Specifications	800
Contractors' Column ... ... Advertisement page	xxx

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 6d.

The Oldest Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

Technical Editor: A. H. ALLEN, M.I.E.E. *Commercial Editor*: A. H. BRIDGE.

Joint Managing Directors: G. H. ALABASTER. E. A. GATEHOUSE, M.I.E.E., A.M.INST.C.E.

Manager and Secretary: E. S. MIDDLETON.

Chairman: H. ALABASTER.

OFFICE, 4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGEKEAY, CENT., LONDON." Code, A B C. Telephone Nos.: Central 8260 and 8261.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

FOREIGN AGENTS:

AUCKLAND, N.Z.: Gordon & Gotch, Albert Street; Peter G. Tait, P.O. Box 392; R. Hill & Son, Matlock House, 33/34, Quay Street; Trade Publications Co., 302, N.Z. Insurance Buildings, Queen Street.
BRISBANE: Gordon & Gotch, Queen St.
CHRISTCHURCH, N.Z.: Gordon and Gotch, Manchester Street.
DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.
JOHANNESBURG, CAPETOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c.: Central News Agency, Ltd.
LAUNCESTON: Gordon & Gotch, Cimitiere Street.
MELBOURNE: Peter G. Tait, 90, William Street; Gordon & Gotch, Queen Street.
MILAN: Fratelli Treves.
NEW YORK: D. Van Nostrand, 8, Warren Street.
PARIS: Boyveau & Chevillet, 22, Rue de la Banque.
PERTH, W.A.: Gordon & Gotch, William Street.
ROME: Ditta P. Maglione & C. Strini, 88, Via Due Macelli.
SYDNEY: Peter G. Tait, 273, George Street; Gordon & Gotch, Pitt St.
TOKYO: Maruzen Co., Ltd., 11-15, Nihonbashi-Tori-Sanchome.
TORONTO, ONT.: Wm. Dawson and Sons, Ltd., Manning Chambers; Gordon & Gotch, 132, Bay Street.
WELLINGTON, N.Z.: Gordon & Gotch Cuba Street.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d.; Canada, £1 12s. 6d.; Colonial and Foreign, £2 1s. 6d. per annum.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "London Joint City & Midland Bank, Newgate Street Branch."

KEEPING THE ELECTRICAL FLAG FLYING.

IT is quite unnecessary for the ELECTRICAL REVIEW to devote much of its space to the General Election which is now occupying everybody's attention. Our readers who have been face to face with the industrial and trade problems that have arisen during the past decade have made up their own minds, and they will be content to allow public orators to "blow their trumpets until they crack their cheeks."

We say this not because we fail to appreciate the seriousness of the issues that are at stake, but because we earnestly desire that electrical industrial operations shall be interfered with as little as possible while the storm is passing over our heads.

The subject of British unemployment is one upon which we, in line with others who have the interests of electrical and allied industries at heart, have spoken with no wavering voice. The Institution of Electrical Engineers issued a notice urging its members to secure that contracts with which they were concerned should be so placed as to promote work for our own kinsmen at Home. That notice stands—it has not been withdrawn—and the need for such counsel to be followed is and will be as great as ever while our works are only partly occupied. The Government requirement that public contracts with the national financial backing or assistance shall be placed with British manufacturers likewise lies unrepealed. The sentiment of municipal corporations, so strongly influenced by the claims of their local unemployed, remains unchanged, for the wintry blasts find the idle ones and their families depressed, disheartened, and without hope.

The national and the Continental situations have not improved, and the demand for British work for British workpeople is not weakened. There has been a long period of weary waiting for trade to develop, and whatever may result eventually from any of the programmes before the country, little immediate betterment can come from any one of them. "Hope," as is said in Germany, "is the poor man's bread," and it may be that the attention that the nation has been forced to devote to his workless condition will kindle a spark of hope in the embers of his heart.

With such considerations as these we may stand dispassionately aside from the political turmoil and watch the procession of the orators, noting their watchwords and listening to their attacks upon each other. Of all men the orator is most in danger of the deadly parallel being produced against him. He has to act in a greater hurry than even the modern journalist, and some of the speeches that have been delivered lately bear evidence of haste, and were it within our province, which happily it is not, we think we could apply the deadly parallel in a very interesting way—especially in regard to speeches bearing upon the trade position.

At General Election times the floodgates are always thrown wide open, but on this occasion the rush of oratory is faster because the period of the contest is to be short. There is reason to be satisfied with this aspect of the situation because the disturbance within the industry that we represent will be less extensive.

The electrical engineering industries have their hands engaged upon orders already booked. As the result of the various measures introduced by the Government, facilities have been afforded for expediting the placing of important contracts, and as the outcome of a desire among public authorities to place orders where employ-

ment would be afforded for additional British workpeople, a good deal of work is in hand, though far from sufficient to call for the full productive capacity of our factories to be exercised. For several months past it has been possible to record successes of our manufacturers in booking orders from New Zealand, South Africa, India, Canada, Japan (in connection with reconstruction operations), and last but by no means least from Soviet Russia. These present discussions therefore need not interfere materially with our manufacturing activity, especially in certain departments.

If there is any interference anywhere with electrical progress, apart from the general drag that public upheavals must inevitably exert upon practically everything, it is feared that it may be in the holding up temporarily of the new installation business and the Christmas electrical apparatus trade. We are glad to note that with its customary alertness, the British Electrical Development Association has quickly taken such steps as lie within its special province to counteract electioneering influences. Our walls and windows will be covered, whether we will or no, with posters telling us Who's Who and What's What, and what we ought to do in order to ———. But the poster which appeals to men of all shades of opinion is that for which Mr. Beauchamp is responsible. It asks for the co-operation of those who desire to maintain electrical interest throughout election time to circulate certain leaflets as freely as possible urging everybody to "Vote for Electricity" after securing a ballot card from the local electric supply undertaking. B.E.D.A. aims at the circulation of these bills by the million, and the co-operation of the electricity supply undertakings and electrical contractors is desired to secure that that shall be done.

So far as the Christmas trade is concerned, this is probably well on the way so far as the manufacturers' and wholesalers' plans are concerned, and there need be no holding up here. If the contractors, stores, and retailers go steadily ahead with their plans, they should have a full three weeks' concentrated trade in electrical presents for Christmas and the New Year. The growth of electrical uses in the domestic field has been so rapid during the last year or two that the Christmas demand for extra devices in already connected houses should automatically increase, and there is very good reason for looking forward to a heavier demand within the next six weeks than we have experienced in the corresponding period of any previous year.

The needs of the moment are such that everybody should continue the policy wherever possible of placing orders where they will make work for our own unemployed. Nothing that has been said by us on this subject would call for alteration under the prevailing conditions of unemployment were there a hundred elections all raging at once. Nor surely do we require to repeat the arguments regarding the effect of confiscation upon the industries wherefrom we all obtain our daily bread. Whether we like the terms, Construction, Obstruction and Destruction or not, and whether we take part in political controversies locally and as individuals or not, we all need to do our part to keep the electrical industry at top notch, and we can do this better by each one sticking to his own last than in any other way.

The Wireless Exhibition.

No one, we should think, could visit the Exhibition which closed on Wednesday last without being deeply impressed by the extraordinary development of this new branch of the electrical industry in a remarkably short period. Little more than a year ago the broadcasting service was inaugurated in this country; before that event the field was confined to amateur experimenters in the legitimate sense, and the market for radio apparatus was extremely restricted—yet already an immense business has been developed, and a very large number of firms are engaged in the manufacture of "sets" and accessories, whilst the name of the retailers is Legion. The trade received a serious setback during the summer and autumn on account of the uncertainty regarding the future of the broadcasting system and the question of issuing licences to the so-called "pirates," who, however, have since demonstrated their good faith by purchasing a quarter of a million licences and regularising their position under the new conditions; the period of slackness has now given place to a time of great activity, and the exhibition was held at a most opportune moment.

The multitude of instruments and parts exhibited was somewhat embarrassing—all the more so in view of the close similarity which apparently existed between different makers' productions. The makers, no doubt, will dispute this assertion, but it is true that there appeared to be little to choose between them except in point of simplicity on the one hand and magnificence on the other. Anyone who wishes to invest heavily in radio apparatus will have no difficulty in satisfying his craving, but the fact remains that a simple set made up of a few components mounted on a board at very small cost may yield results as good as can be obtained from the most costly and ornamental cabinet work. We were pleased to see, therefore, that prices ruled much lower than a few months ago, and many sets of quite simple though adequate construction were shown. Although broadcasting may be correctly regarded as a luxury, it is a luxury within the reach of almost everyone, and in many home circles is gaining recognition as a necessity. Within crystal range of a transmitting station the whole outfit, completely fitted up and provided with British headphones, can be obtained for a sovereign or even less. Moreover, a loud-speaker can now be operated from a crystal set without the use of valves, only a 6-volt dry battery being required.

It is a pregnant fact that if the efficiency of the telephone could be raised from 0.1 per cent. merely to 1 per cent.—an absurdly low efficiency even then—every set would become a loud speaker right away. That after all these years of experiment and research the telephone, with which such marvels have been accomplished, should still utilise only one-thousandth part of the energy put into it is amazing—what a field for invention it offers!

Mercury and Other Turbines.

The fact that a high thermal efficiency is by no means synonymous with high commercial efficiency is too obvious to need emphasising. The former is necessarily associated with the use of high temperatures, and it is beyond doubt that the advantages that would follow as a consequence of a bettered thermal efficiency might be more than outweighed by the interest on the enlarged capital expenditure that would necessarily be involved in effecting the thermal improvement; the increased rate of depreciation of the plant; and, possibly, by the reduced reliability of the machinery.

In view, however, of the generally accepted necessity of sincere efforts being made with the object of conserving our national fuel resources, the fact that many small and moderate sized electricity undertakings are operating uneconomically is a state of affairs that should not be tolerated any longer than is unavoidable. It is not practicable to effect any considerable improvement in this respect except when new stations are being built, or when old generating machinery is being replaced by new, and it would seem that the present, when so much reconstruction is being undertaken in electricity works, is therefore the time to "take stock," or to review the position.

During recent years the developments that have taken place in electricity generating stations have in the main related to the use of high steam pressures, large-powered high-speed turbo-generators, improved condenser air-extraction apparatus, and better methods of boiler feed-water heating; with the result that thermal efficiencies (coal to switchboard) of the order of 20 per cent. have been recorded, and a figure of 24 per cent. is even predicted; but it will be learned from the abstract of a

paper which will be found elsewhere in this issue that any materially better performance than that indicated by the above percentage is not to be expected in the future if present practice is adhered to.

The author of the paper referred to discusses the possibilities of the binary-fluid turbine, using mercury and water as the working substances, which has a theoretical efficiency of no less than 55 per cent. He states that such an installation would show an improvement of 32.3 per cent. on a steam plant, and that, although the efficiency of the mercury-vapour steam turbine is still somewhat inferior to that of the Diesel and the binary-fluid Still engines, it possesses all the important mechanical advantages of the steam turbine. The operating results of the installation that was recently placed in commercial service in the U.S.A. will be awaited with interest.

Indications that efforts are being made to improve upon modern turbine practice are not lacking, inasmuch as several papers describing new types of turbine have recently been read, which we hope to review in due course. Such proposals are not submitted in a frivolous spirit, and it therefore behoves all who have the future of the industry at heart to devote to them that balanced consideration which they merit.

Globular Lightning.

In our "Correspondence" columns to-day Prof. W. M. Thornton draws attention to a paper of which an abstract appears elsewhere in this issue, in which in 1911 he put forward a theory of the constitution of ball or globular lightning which seems to agree very well with the observed phenomena. There is perhaps no other manifestation of Nature's processes which is so mysterious, so capricious, or so intriguing as globular lightning, unless British weather as a whole be taken into comparison, and the solution of this problem will be welcomed; we are not yet in a position to reproduce the phenomenon by artificial means, though the development of million-volt transformers suggests that the feat may be accomplished some day.

The subject is dealt with also by Dr. G. C. Simpson, F.R.S., in the current issue of *Nature*, in the course of an article on thunderstorms arising out of Dr. Russell's presidential address. Dr. Simpson refutes the general belief that ions form nuclei for the precipitation of atmospheric moisture, but indicates that the breaking-drop theory of the origin of thunderstorms is worthy of acceptance, when supplemented by reference to the part played by hail. It appears that "the fall of the hail effects the separation of electricity which gives rise to the large electrical fields necessary for a thunderstorm." He also explains the occurrence of electrical phenomena in connection with dust storms and snowstorms. With regard to ball lightning, he is unable to accept Dr. Russell's brush discharge theory, and inclines to the view that the ball may consist of the "active nitrogen" studied by Lord Rayleigh, which continues to glow for some time after it has been subjected to an electrical discharge. Mr. E. Kilburn Scott, in our issue of November 2nd, outlined a theory that the ball might consist of nitrogenous compounds, whilst Prof. Thornton makes out a strong case for ozone. It appears reasonable to surmise that each of these hypotheses contains a portion of the truth, and to anticipate that the problem may soon be solved.

Trade Journals and Empire Trade.

Lord Burnham delivered a very timely speech a few days ago on the "Influence of the Press on the Development of Empire." His lordship occupies a unique position. He is unquestionably the most widely and sincerely respected of all the great newspaper proprietors and he is always both careful and polished in the choice of his words and the turning of his phrases. We like immensely all that he said respecting the superiority of the newspaper Press of the Empire and the need for the independent spirit, and we read with interest his criticism of the American tendency that has found its way into some of our organs. He remarked that the newspapers of Australia and New Zealand "were more English than many of the English papers which had been so largely altered by American novelties." But we wish there were a greater desire on the part of the general newspaper authority to recognise the large part that has been played by the great British technical and trade journals in promoting and furthering trading relations within the Empire. Happily, the place that is filled by the trade journal in bringing the British manufacturer and the overseas purchaser or user into touch is known to the manufacturers and other exporters as the result of their utilisation of its service, and the tribute of the Britisher overseas is ungrudgingly given.

It has been the custom in time of emergency for those in high places to utilise the facilities provided by the Trade Press and at other times to forget their existence. The daily Press may do a great work in keeping our Colonial kinsmen informed of the state of Home affairs and Home opinion, but with regard to the promotion of actual trading transactions it is not in the same street as the Trade Press. We are glad to see that Mr. Walter Judd has brought this point out in a letter to *The Times* in which he comments on Lord Burnham's address. He complains that the amount of good work done by the Trade and Technical Press in drawing atention all over the world to goods made by British manufacturers is hardly recognised. "England could not exist without its factories, and their output—especially the quality of that output—has enormously benefited by the Technical Press." Our trumpeter is not dead—peradventure he sleepeth or is on a journey—but in Press circles honour should sometimes be given where honour is due.

Medals for Meddlers.

It is reported that silver medals have been presented by the Electrical Trades Union to the electricians who struck work at Fulham electricity works in support of the dustmen. It is not unusual to strike a medal, but to medal a strike is to us an entirely novel procedure. That the reward for meddling should take this form is, however, not inappropriate; presumably the Fulham electricians will henceforth be known as the meddlers.

The Settlement of the Boiler-makers' Dispute.

The disagreement between the Boilermakers' Society and the Shipbuilding Employers' Federation, which for seven months has continued to add further to the burdens borne by British industry, has terminated in a compromise which might have been arrived at in the first place.

As in international disputes, both sides find themselves in worse case than before, and, moreover, innocent outsiders have suffered owing to what was, after all, a grievance affecting a comparatively small section of industry. The apportionment of blame as between the two sides in the dispute is, as usual, difficult and indeed unprofitable. Again the sanctity of agreements was attacked, and again it was forgotten that it is possible to modify agreements if special circumstances indicate that modification is necessary. In the end both principles are confirmed—the agreement is to remain, although varied in certain respects where its application to the boilermakers is not on all fours with its application to the other trade unions involved.

The morals to be drawn from this case have been proved in many previous cases of a similar nature—strikes and lockouts benefit neither party; those who are not responsible for disputes suffer as much as anybody, and the welfare of the nation is imperilled; and the settlement is generally one that could have been arrived at much earlier.

It is deplorable that we are so unwilling to profit from the precedents and lessons of the past. However, the dispute being now as good as ended, both parties should concentrate on the revival of the industry upon which they, and so many others, depend.

ELECTRICITY IN MINING.

From the second annual report of the Secretary for Mines, just recently issued for the year 1922, we learn that the total output for the year amounted to 249,606,864 tons, which is the highest figure reached since the year 1916, and that the output per person employed, viz., 217 tons, is the best since the reduction of underground hours from eight to seven in 1919—which is exceedingly satisfactory.

The volume and regularity of employment compared very favourably with those of other trades. The number of unemployment books lodged by coal owners fell from 10.4 per cent. in January to 4.6 per cent. in December, the average figures for all trades being 16.2 per cent. and 12.2 per cent. respectively. Except during June and July, there was a steady increase in the number of wage earners on colliery books, the aggregate figure rising from 1,061,199 at the beginning of the year to 1,129,539 at the end of it. Short time was reduced, until in November and December coal was being wound at the pits on an average of 5.50 to 5.56 days per week, or nearly as many as in the boom year of 1913, when the output was in the neighbourhood of 270 million tons.

Another satisfactory feature of the year was the remarkable increase in the volume of coal exports, the total quantity being 64,198,384 tons, which exceeded the quantity exported in the previous year by over 39½ million tons, and was only 9¼ million tons less than the record year of 1913. Prices, however, had fallen from 65s. 4d. per ton at the beginning of 1921 to 24s. 11d. at the end, and they still further decreased during 1922, when prices ranged from 23s. 10d. to 22s., the average for the year being 22s. 7d.

The Chief Inspector of Mines reports that the horse-power of electrical apparatus now used in and about 1,557 mines has more than doubled during the past ten years. At the end of 1912 the total horse-power installed was 510,756; at the end of 1921 it was 1,148,103; and at the end of 1922, 1,240,174. Of this, 688,026 was employed below ground, chiefly in haulage, coal-cutting, and pumping, while 552,148 was employed on the surface for winding, ventilation, haulage, washing, or screening coal, and various other purposes.

Although no distinction is made in the electricity regulations between alternating-current and direct-current systems, the Departmental Committee charged with the duty of formulating these regulations in 1910 recorded the opinion that the development in favour of alternating current, which was taking place even at that date, was in the right direction. Apart from considerations of safety, an alternating-current system has inherent advantages of an engineering character for mining use, especially where it is desired to transmit a large quantity of energy for any considerable distance. From information furnished in the annual returns from mines, the following tabular statement has been prepared to indicate the relative extent to which the two systems of electric power were in use at the end of the year:—

Inspection division.	Horse-power of electric motors installed using				Per cent. of h.p. a.c. current based on total of first and second columns.
	A.c. only.	D.c. only.	Mixed systems.	Total h.p. of motors installed.	
1. Scotland ...	102,351	80,983	46,027	229,361	55·8
2. Northern ...	204,318	12,523	75,769	292,610	94·2
3. York and N. Midland	124,088	41,008	63,916	229,012	75·2
4. Lancashire and N. Wales	57,340	10,392	4,377	72,109	84·7
5. South Wales...	222,215	31,462	69,018	322,685	87·6
6. Midland and Southern ...	43,723	27,293	23,381	94,397	61·6
Total	754,035	203,651	282,488	1,240,174	78·7

The table shows that in those mines where either alternating current or direct current alone is used, the preponderance in favour of alternating current is in the ratio of approximately 3¾ to 1, on the basis of the horse-power of motors installed. As a number of mines use both systems, owing doubtless to their being in a transitional stage electrically, it is not possible with the available data to determine exactly the proportion for the whole of the electric power installed, but 77 per cent. of the total has been definitely allocated to one or the other system. Direct current appears to have its stronghold in Scotland, where small pits are a characteristic of the coal-field, while alternating current predominates especially in the North-Eastern area, in which the Tyneside electric power companies were pioneers in the development of polyphase transmission on a large scale.

The same tendency in favour of alternating current is exhibited by a scrutiny of the notices of intention to introduce electricity which have been received with respect to the year under review. It is to be understood that these notices usually refer only to the proposed use of electricity in a ventilating district in which electric power has not been in use before, or its employment has been objected to at some previous date under the provisions of Section 60 (1) of the Act. The data obtained from this source must not be regarded, therefore, as representing the whole of the new equipment, but it is sufficiently representative. The next table shows that more than four-fifths of the horse-power of electric motors proposed during the year relates to alternating-current systems.

Inspection division.	No. of notices applicable to		H.P. of motors referable to		Total h.p. of motors.	Per cent. of a.c. current to total h.p.
	A.c.	D.c.	A.c.	D.c.		
1. Scotland	15	15	875	1,437	2,312	37·8
2. Northern ...	30	3	3,394	72	3,466	97·9
3. York and North Midland ...	12	10	807	492	1,299	62·1
4. Lancashire and North Wales	13	2	1,545	34	1,579	97·8
5. South Wales ...	13	6	5,224	252	5,476	95·4
6. Midland and Southern ...	15	7	2,576	830	3,406	75·6
Total	98	43	14,421	3,117	17,538	82·2

(To be continued.)

Amplified Oratory.—Amplified oratory is evidently to be one of the features of the election campaign. Just as at Plymouth Mr. Baldwin addressed two large meetings from one platform, and Mr. Churchill at Manchester did the same, so other leading protagonists will, with the aid of microphones, land wires, and amplifiers, be making speeches frequently during the next few weeks to two audiences at once. An effort was made to obtain the apparatus used at Manchester for Mr. Lloyd George's meeting at Northampton, but the time proved insufficient. At present the broadcasting of political speeches by the B.B.C. is prohibited, but nearly half a million listeners-in will be given a selection of the more interesting election results on December 6th. Meanwhile the rival party organisers are competing for amplifying sets, and one of the central offices, it is said, contemplates purchasing an expensive outfit outright and sending it round for the use of candidates. "Provided line facilities are available," said an official of the Western Electric Co., "there is no limit to the distance over which a speech can be carried."—*Evening News.*

Ball Lightning.—Returning to Brixham, Devon, on November 10th, the skipper of the fishing smack *Flowerlet* reported that while trawling about 30 miles south-east of Berry Head, Devon, on Friday evening, the vessel was struck by two balls of fire which tore away the upper planks in the bow from their bolts and knocked a piece off the rail. The smack appeared to be lifted out of the water and the crew experienced what felt like a severe electric shock. The first flash passed between the masts, and the second made a hole in the jib. The mastlight was extinguished.—*Daily Mail.*

REPAIRING BROKEN ELECTRODES.

By "LAPIS LAZULI."

One of the most disagreeable duties which the electric melter has to perform when conducting refining operations in arc furnaces is the removal of broken electrodes from the hot furnace. This is not so troublesome a job when one of the sleeves of the electrode fractures, as the work resolves itself into simply unscrewing the broken part and placing a fresh one on the carbon worm which holds the sleeves together.

Although the material of which the electrode is composed is of a high standard quality, it cannot prevent the carbon worm from breaking at frequent intervals. When this breakage of the worm occurs above the clamp, or bracket, which clasps the middle portion, the work of inserting a fresh one is a comparatively simple matter.

A more common occurrence is the breaking of the carbon worm below the iron clamp; this gives considerable trouble even to the most experienced furnace workers. The lower portion of the carbon pole, as a general rule, is of such a thickness that when accidents do occur it cannot fall into the furnace, but sticks to the inner wall of the water cooler. If this precaution were not taken, and the electrode allowed to fall into, say, molten steel, it would raise the carbon content of the latter so considerably that much time would have to be spent in reducing this element alone when operations were restarted.

Although the greatest possible precautions are taken to minimise the loss of heat by radiation (from an economical standpoint), the roofs of electric furnaces of the arc type are always much too warm for human beings to work on for directly.

Even the electrodes, which are usually regarded as being very poor conductors of heat, are far too warm to be touched with the naked hand. The removal of broken electrodes and replacing them with new ones was a tedious operation when arc furnaces were first applied on the large scale.

Any method which takes much time, and thereby offers the molten metal an opportunity to solidify, is of very little value to the practical melter. The effects of expansion and contraction caused by solidification of metal would be so severe that the bed of a furnace would be almost wrecked. It is scarcely necessary to add that all other repairs conducted while the metal remains molten must be performed with the utmost rapidity.

Manipulating Carbon Worms.

When breakage takes places at the lower portion of the electrode, the current is switched off immediately and the overhead travelling crane is brought directly above the furnace. To prevent loss of heat while the current remains off, the charging door is clayed up with fireclay. A pair of iron rests are fitted on the iron shell, which encases the furnace, in the near proximity of the electrodes. Planks are placed on top of the rests so that furnacemen can stand without discomfort from the heat while working. If the operations are of too prolonged a character, the wood begins to char and smoulder, due to the heat emanating from the roof, but this cannot be easily avoided, and new planks are provided when necessary.

The iron clamp which holds the carbon pole in position is unscrewed (but not opened up), so that the upper sleeve may be lifted up without any danger of being broken or damaged. To remove this upper portion of the broken sleeve, a fresh carbon worm attached to an iron T-shaped handle is screwed in through the tapped hole at the top.

The chains of the crane are then lowered and attached to the handle by means of a thick rope; the carbon is raised from the furnace, and placed on a warm part of the stage. Rough handling, or sudden chilling of the hot carbon, might result in this expensive item being broken.

The raising of the remainder of the electrode (the top of which sometimes lies beneath the level of the water-cooling bush) is a more tedious job. A small auger is screwed into the carbon in a slightly diagonal line, and, when firmly fixed, a rope is attached to the handle, and the electrode is raised to the level of the clamp by means of the crane, when it is firmly bolted to the former. An equally effective method is to lower the clamp by means of the gear wheel and work the auger through the open space of the bracket, after which the whole can be raised by revolving the gear wheel.

The broken worm in the lower sleeve is then unscrewed. To accomplish this, two small holes are bored at opposite sides of the worm by means of a small hand drill. Two old file ends are hammered into the holes, and the broken worm is removed by placing an iron rod between the files and revolving it to unscrew. All carbon dust which has accumulated from the drilling is swept out of the hole with a small brush. A new worm is not inserted at this point, as the continued heat sometimes makes working conditions very unpleasant.

The upper sleeve, which was first removed and has cooled, is easily provided with a fresh carbon worm. It is raised by means of the crane, and, while hanging, is screwed to the lower portion. The position of the electrode in the clamp is adjusted as required, when the melting can be restarted. If the door has been properly "clayed up" meanwhile, the loss of heat will be comparatively small, as the foregoing operations can be completed in little more than 15 minutes by an experienced furnaceman.

The operations described can be applied to repairing the electrodes of almost all types of arc furnaces.

In conclusion, it might be added that few text-books on electric furnaces or electro-metallurgy even touch on practical subjects of this kind, and when they do, the directions are given in such meagre detail as to be of little value to the practical melter.

Vaporised Metal.—*Science Service* reports that a new process for spraying metals upon other materials to give a solid metal coat has been invented. The essential of the process is that the metal is first vaporised and then sprayed on to the surface to be coated by means of a powerful blast, which congeals it to the solid form as quickly as it strikes the surface. Details of the process are withheld by the Bureau of Standards at present for military reasons, except for the statement that it is based on a new principle and that electricity is used in the vaporisation process.

Soldering of metal to glass, a difficult problem, has been easily accomplished by means of this method. The glass is first coated with a layer of copper and the metal connection is then soldered to the copper. Processes somewhat similar are used in the soldering of aluminium.

A coating of copper one-thousandth of an inch in thickness may, so its inventors say, be applied at the rate of 2 sq. ft. a minute and at a cost of two cents a square foot exclusive of the cost of labour. Cheaper and more easily fusible metals, such as lead, would cost less.

Czecho-Slovakian Trade.—In a review of the foreign trade of Czecho-Slovakia by the Commercial Secretary at Prague, which appeared recently in the *Board of Trade Journal*, the value of electrical machinery imported during the first nine months of the present year is given as 68 million crowns. Other machinery and apparatus imported was valued at 134 million crowns. Germany was pre-eminently the principal supplier; the United States was far behind as second; while the United Kingdom was ninth in the list. Exports of machinery and apparatus during the first nine months of the year reached a value of 119 million crowns. Germany and Austria were the principal recipients of the country's exports, and the United Kingdom took third place. It is noted that in September Germany was not the principal buyer owing, probably, to the rapid fall of the mark during that month.

THE ALL-BRITISH WIRELESS EXHIBITION.—II.

SINCE the position of the home constructor of radio receiving sets was regularised by the issue of the constructor's licence, the demand for sets of parts has become accentuated, and it is all to the good of the science to find that there is an increased disposition on the part of home constructors to confine themselves to circuits of known capabilities and to instruments manufactured by firms which have some reputation to stake upon the quality of the components and the class of circuit which they offer. This renewed demand for parts is now being met in various ways by different well-known makers.

MESSRS. ROGERS, FOSTER & HOWELL, LTD., supply practically all of the well-known reaction instruments in complete sets

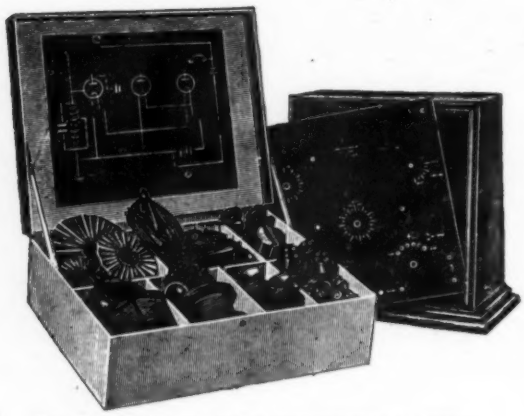


FIG. 1.—R. F. H. HOME CONSTRUCTOR'S OUTFIT.

of parts, and the attractive way in which their valve parts are put up is well shown by the accompanying illustration, fig. 1. It will be noticed that the complete set of components is packed in a strong box, each part being neatly nested in its appropriate division, and a clear drawing of the circuit is mounted inside the lid. In fact, the box serves as a convenient receptacle for the various parts which every amateur accumulates in connection with his set. The ebonite panels are drilled and engraved all ready for screwing down in the polished cabinet which is also provided.

The valve sets which are available in this line are the components for the 2- and 3-valve "Minor" series of instruments (designed for the reception of British broadcasting only), and standard reaction instruments (for both British and Continental broadcasting) in the 2-, 3-, and 4-valve sizes. These instruments have been modified slightly this season by the valves being mounted underneath the panel, so that it is now possible to close down the lid without first removing the valves. Increased accumulator capacity is also provided.

FIG. 2.—"POLAR BLOK" CRYSTAL DETECTOR.

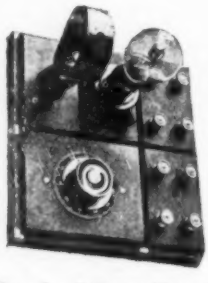


FIG. 3.—"POLAR BLOK" H.F. AMPLIFIER.

Crystal sets are shown, one with a wavelength range up to 500 metres, and the other up to 3,000 metres, as well as various styles of valve amplifiers to match different styles of cabinet.

A specimen of the firm's "Voxola" instrument was shown in a Jacobean cabinet resembling a piano case. The upright portion contains a frame aerial, and a loud speaker is fitted in the base. The keyboard forms the panel of the instrument, which is of the 7-valve type (3 h.f., one detector, and 3 l.f.).

An attractive method of building a set is that adopted by the RADIO COMMUNICATION CO., LTD.; in addition to useful accessories, cabinet, and "book case" or sloping-panel 4- and 7-valve sets, the firm demonstrated its method of constructing sets on the "Polar Blok" system, which is universal in its adaptability to any type or make of equipment. One of the leading features of this apparatus is the simplicity with which it is possible for an amateur to build a set to any circuit and to change or extend it economically, always maintaining the finished appearance of high-class workmanship. When assembled, the set can either be enclosed in a wood case, as shown in fig. 2 (a variable condenser-tuned crystal detector), or mounted on four frame legs—the most convenient form when subsequent extensions are contemplated, as illustrated in fig. 6. A one-stage h.f. amplifier for addition to a crystal or valve detector is shown in fig. 3, while fig. 4 is a front view of a crystal set with one stage of h.f. amplification, fig. 5 being a back view which indicates the simple mounting and wiring. Fig. 6 shows a completely assembled set having one h.f. valve with tuned anode and reaction, a rectfying valve, and one stage of l.f. amplification, all the coils in the tuning circuits being interchangeable. The basis of the "Polar Blok" construction is a tubular frame forming spaces for the attachment of panels on which the various components

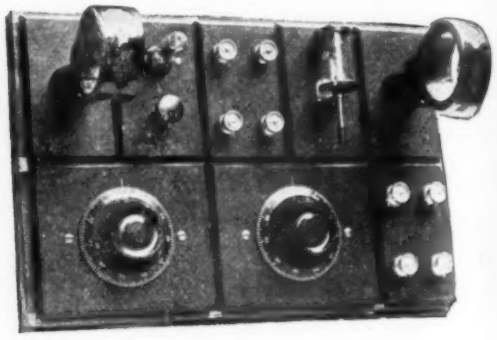


FIG. 4.—H.F. VALVE-CRYSTAL SET, FRONT VIEW.

are mounted. The size of the whole black matt ebonite panels is 5 in. by 4 in., and of the half panels 2½ in. by 4 in. The tubular members are of blued spring steel and the junction pieces are alloy die-castings.

THE IGRANIC CO., LTD., has not been slow to discern that importance is attached to matters of tuning, and that it is demanded that, while high-frequency devices should be capable of giving resonance effects of a pronounced order, they should not be wasteful. The Igranic variometer is not merely ordinary; it is resultful and provides an adjustment control that does not permit the hand to interfere with tuning. There are two patterns: Type H is intended for tuning the aerial circuit, whether a crystal or a valve be employed, and type S.R. is useful for tuning plate circuits and, in general, those of a selective character; both are equipped with a fixing bracket and a dial with knurled knob. Another exhibit was

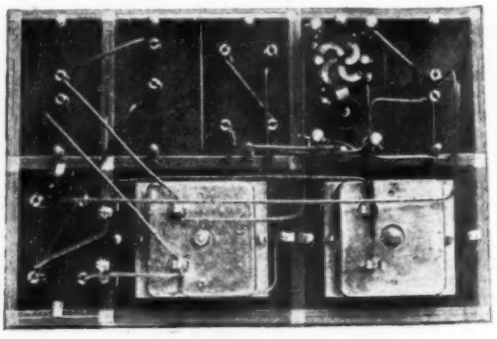


FIG. 5.—H.F. VALVE-CRYSTAL SET, BACK VIEW.

the variocoupler, a substantially-built component for use with any of the usual forms of casing. The tappings are so arranged that any number of turns may be brought into use if a couple of multi-way switches are suitably joined to the tappings. A novel little device that will have a practical appeal is the vernier friction pencil for adjusting variable condensers, variometers, and other tuning arrangements, and is usable in two different ways: A small hole may be drilled in the casing of the tuner or other instrument and the pencil inserted. In this position a rubber ring on the pencil will engage with the bevelled face of the dial, and by turning the pencil the dial will be moved around. Another method is to fit the pencil into the dial with the assistance of a clip attachment supplied with it. It would be possible to use only one pencil for a number of controls, transferring it from hole to hole as desired.

The company also exhibited two variable rotary rheostats built on similar lines, but one has a rotary extension at the rear. By means of this, a small strip of additional resistance wire which it carries can be brought into circuit on manipulating an extra knob mounted in front of the ordinary one. It is a device which will be welcomed by all who use high-frequency amplifiers for obtaining very exact filament-current values with various values of grid potential. Both the rheostats are of a robust character, and the variation from zero to 4 ohms which they effect is obtained with smooth graduation

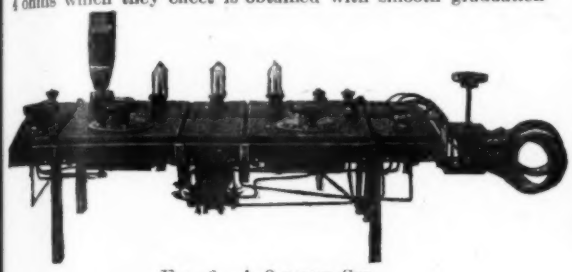


Fig. 6.—A 3-valve Set.

and negligible wear upon the parts. The "Gimbolder" holder, an arrangement by means of which "gimbal honeycomb coils" may be adjusted to positions of exceedingly wide variation, is a specially useful article, because it enables these coils to be made use of in practically every description of high-frequency circuit, whether valves or crystals be in use. The rejection and selection securable are largely governed by the flexibility and fineness of tuning which the apparatus in use affords.

A few other specialities might be mentioned, such as the "Igranic" a.c. lighting set for energising filaments in place of accumulators, thus minimising noises by special circuit arrangements that have been incorporated in the design. Also we might mention a special intervalve low-frequency transformer which, it is claimed, may even be installed in numbers in such an instrument as a high-frequency amplifier without producing inductive interference.

Messrs. Siemens Bros. & Co., Ltd., had on view a 3-valve set designed with a view to minimising interference from other stations, and for this purpose it is equipped not only with the usual arrangements for tuning the aerial, but also with a loosely-coupled closed secondary circuit which can be cut out if desired, and provision is also made for cutting out the third valve (low-frequency amplifier) when not required. The valves are on the back of the panel, and the cabinet provides room for the h.p. battery.

Owing to simplicity in use, the type CV set is gaining favour, particularly now that the augmented number of broadcasting stations makes its limited range of reception no obstacle. The 2-valve low-frequency amplifier, type S.B. 36, has been specially designed for use with the above receiver, and is contained in a mahogany box with all the necessary apparatus, excepting the filament battery and telephone headgear, and a switch enables either one or two valves to

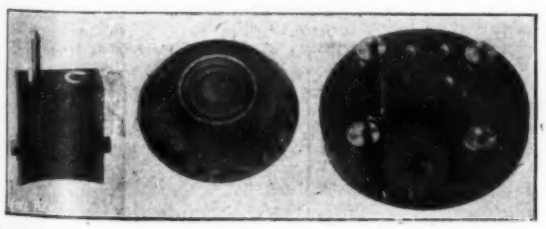


Fig. 7.—Examples of Siemens Ebonite Products.

be used. Switches on the instruments enable the following combinations to be employed:—Crystal reception with one, two, or three note-magnifying valves, or a valve rectifier with one or two note-magnifying valves.

For use in country districts or places where there are no facilities for recharging accumulators, the company manufactures a special dry cell for the filament circuit. This cell unit has a sufficiently large output to permit the set being worked for one hour per day for about six months. The Siemens loud-speaking receiver is made in three types, for 120, 2,000, and 4,000 ohms respectively, and other exhibits were inductance coils, low-frequency intervalve transformers, crystal detectors, filament resistances, 6-way telephone adaptors, &c.

To meet the demand for a convenient form of indoor protector, combined with an earthing switch, a combined lightning protector and switch has recently been introduced, and was included in the exhibit, as were also fuses, jacks, plugs, and cords, and a representative selection of dry cells and batteries. An interesting feature was the small section devoted to ebonite, fig. 7, for there were shown the ingredients of this somewhat mysterious substance, which the company makes at its factory at Woolwich.

Messrs. Autovetors, Ltd., amongst other things, showed the "Clix Electro-link," which consists of a combined plug and socket which provides an instantaneous contact suitable for any point of electrical connection. It may be employed with decided advantage as a multi-terminal, contact stud, valve leg or socket, coil plug or socket, battery plug or socket, multiphone plug or tag, soldering tag, dead-end, or any other type of switch may be built to meet any requirements.

The variable bridge condenser (3-E. V. C.) comprises three

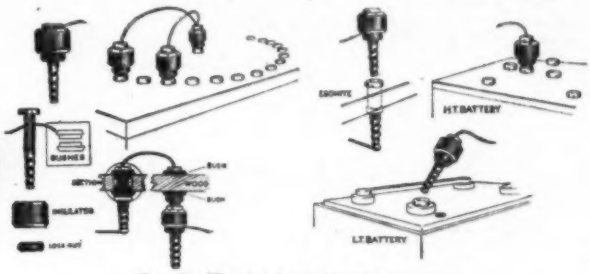


Fig. 8.—The "Clix Electro-link."

sections, each consisting of a tier of rotary or semi-rotary parallel plates of one-third disk area. Whilst providing all the essentials of the ordinary 2-electrode condenser, it has the all-important addition of the coupling of the third electrode, which may be employed with advantage in many applications. The bridge-tuning and rejector unit embodies this type of condenser, thereby applying bridge methods to reception. Further units are being manufactured which permit the application of bridge methods to amplification, rectification, regeneration, and magnification. The "filtron," a variable grid leak and potentiometer, has proved efficient in circuits which necessitate a variable high ohmic resistance of precision, and the "staticrster" is a protective device against damage to insulation of coils and condensers, which causes "noisy" reception.

Marconi's Wireless Telegraph Co., Ltd., exhibited a full range of receivers, voice amplifiers, and loud-speaking equipment, amongst which the new crystal "Junior" is an improved form of set. The multivalve receiver is a later model of the set known as R.B.7, a longer range having been secured by the aid of a certain amount of reaction. A neat proposition that serves two purposes is a table for supporting the receiving apparatus, which at the same time forms a directional frame aerial.

The Marconiphone crystal outfit has two alternative crystals; the carborundum is provided with an automatic adjustment,

Fig. 9.—Marconiphone, V.3 Type.

while the galena employs the usual "cat's whisker." The former is more reliable and will work for long periods without needing adjustment, but the latter, while requiring more care in handling, gives sharper reception. A reversible range block enables the set to be used with either a long or short aerial without complicated adjustment. The portable valve-crystal set makes use of a avlve for h.f. amplificatjon, a crystal detector, and the same valve for l.f. amplification. Non-inter-

changeable plugs prevent connections being wrongly made, which is a feature also of the V.3 set, illustrated in fig. 9. Reception can be obtained on any wavelength from 300 to 2,900 metres by means of a simple interchangeable range block and regenerator units. Where local conditions are known to give average reception the Marconiphone V.3 will operate a loud speaker up to a range of approximately 100 miles.

A modified system of reaction is employed in conjunction with a special circuit, and tuning adjustments are made by means of spades actuated by the rotary motion of two handles outside the case of the instrument. A fixed resistance is provided, together with a switch for lighting or extinguishing the filament, and two tone-arm switches, each with three positions, are fitted on the deck of the instrument for varying the reception strength.

THE ELECTRICAL TRADES BENEVOLENT INSTITUTION.

Annual Festival Dinner.

On Wednesday evening last week, November 14th, the annual festival dinner of the Electrical Trades Benevolent Institution was held, as usual, at the Trocadero Restaurant. The president of the festival was Sir Philip Nash, K.C.M.G., C.B., who was supported by the vice-presidents and committee of the Institution. There were present about 115 guests and well-known supporters of the Institution, and the presence of ladies added much to the success of the function.

Following the loyal toasts the chairman, in toasting the E.T.B.I., pointed out that, short as had been his connection with the great electrical industry, no one realised more than he its importance; its phenominal growth was not accidental, but due to painstaking research and development, each stage of which gave rise to a new industry and broadened the horizon. With it had grown fine organisations—educational and research, which were essential; manufacturing facilities, which were second to none; the I.E.E., which was most necessary for the industry; a well-conducted electrical Press, which helped and supported the industry; and lastly, the E.T.B.I., which deserved the support of all. However large it grew there would always be cases within its province and duty to help, and he appealed to all to give the Institution their fullest support. Particularly did they need regular subscribers, because, although the invested funds had now reached over £20,000, they were unable to grant as many pensions as they would wish, and it was only out of invested funds that pensions could be granted. However, the industry was young and the matter might cure itself in time, but it inovlved all making an effort to assist.

Mr. Dane Sinclair urged that help should be forthcoming without too close inquiry being made into the reasons for their less-fortunate brethren having fallen. They had temptations to which the more fortunate were not exposed, and nothing could give more satisfaction than the knowledge of having provided a little timely help for the unfortunate.

Mr. J. Y. Fletcher referred to the excellent work of the chairman on behalf of the Institution, and accentuated his remark that the fund was numerically weak; there were not enough members. Electrical men were proud men, and they did not come forward until the shoe pinched—and pinched much harder than in other industries. The Institution should have a membership of at least 50,000 at 10s. per year. In proposing the health of the chairman he thanked him for his assistance in collecting the handsome subscription which they had received that night.

Sir P. Nash, in replying, read several letters and telegrams from members regretting their inability to be present, including one from the president. He announced that the collection had reached £1,076 up to dinner time, and that during dinner that sum had been increased to nearly £1,250, which compared favourably with last year's collection. Contributions were, however, still to come from the provinces.

Mr. F. B. O. Hawes, hon. sec., referred to cases in which help had been afforded. In not a single qualified case had assistance been refused, but they were limited in their work on account of the size of the funds; it was necessary to build up funds out of which to grant pensions. When comparing similar organisations he had been struck by the fact that very few legacies were left to the E.T.B.I., but that matter would probably be overcome as the industry grew older. The provinces had helped nobly, but the Institution was not sufficiently known there, and he appealed to the ladies present to assist in forming local committees and in unearthing unknown cases where help was needed.

During the evening a programme of music and song by Miss O. Sturgess and Messrs. P. Brunet, S. Bennet, and B. Flanders was greatly appreciated.

NOTES FROM CANADA.

[From Our Special Correspondent.]

Less than twenty years ago the Hydro-Electric Power Commission of Ontario made a contract with the Ontario Power Co. for the supply of 100,000 h.p. from Niagara Falls; many people scoffed at this as they thought that such a large amount of power would not be used in Ontario for many years. At the present time the aggregate peak loads of all the Commission's systems amount to about 650,000 h.p., while the supply from Niagara Falls alone is about 500,000 h.p., and the demand is growing so rapidly that Sir Adam Beck, chairman of the Commission, is predicting a serious power shortage within the next four or five years, unless the great potentialities of the St. Lawrence River are developed, and apparently the question of building large steam plants is receiving consideration as an alternative to obtaining more hydro-electric power, either from the Niagara or the St. Lawrence River. The difficulty in the case of the Niagara River is that Canada is already taking, under the terms of an international treaty between Great Britain and the United States, almost all the water which has been allotted to her, and she cannot have more without a revision of the treaty.

Still another matter is the fact that the Commissioners of the Sanitary District of Chicago have been diverting water from Lake Michigan, for some years past, into the Mississippi River, for sewage purposes and have, incidentally, been generating some power by means of this diverted water. The situation appears to be that the Commissioners, desiring to obtain a large flow of water in order to dispose of the sewage, applied to the Legislature of the State of Illinois and secured permission to divert something over 4,000 cu. ft. of water per second from Lake Michigan.

Sir Adam Beck has recently intimated that Canada knows nothing, officially, of any such permission having been granted, and he claims that, as the waters concerned are international, the State Legislature of Illinois had no power whatever to grant such permission as the Chicago Commissioners claim to have obtained.

To make the matter still worse, the Chicago Commissioners have for some time been diverting from 8,000 to 10,000 cu. ft. per second or practically double the amount to which even they themselves lay claim. On disputing the right of the Chicago Commission to take any water at all without the sanction of both of the Governments of the countries between the boundaries of which the waters of Lake Michigan flow, it is claimed that the quantity of water actually diverted would, if allowed to flow over Niagara Falls and down the St. Lawrence River (as it would do if not diverted), be sufficient to furnish 500,000 h.p. continuously.

Further, it is claimed by the navigational interests of the Great Lakes that this alleged illegal diversion of water has so lowered the levels of some portions of the waterways as to interfere seriously with navigation.

In order to remedy this injury to navigation, which injury is apparently admitted by the Chicago Commission, this body is willing to build dams at certain points in order to restore the lake levels, and so leave navigational interests unaffected, but it is pointed out by Sir Adam Beck that this course will not put back the diverted water, and that the actually available power will still be 500,000 h.p. less than it should be. With the exception of the Commissioners of the Chicago Sanitary District, and no doubt many residents of Chicago, there seem to be few, if any, people, either in Canada or in the United States, who are willing to concede to the Commissioners the right to divert water from the Great Lakes as they are doing; in fact, in the United States itself there is a considerable amount of active opposition to this procedure.

The whole matter is further aggravated by the fact that the Commissioner's needs will probably grow larger as time goes on, and they will be asking for still more water in the future. This statement seems to be fully substantiated by the declaration of Sir Adam Beck, that the late chief engineer of the Sanitary District stated that it was his hope and intention to excavate a canal, with a capacity of 16,667 cu. ft. of water per second, whereas the present canal is said to have a capacity of only 14,000 cu. ft. per second.

As the diversion of water from any portion of the international waters of the Great Lakes and of the Niagara and St. Lawrence Rivers has been, and is, up to the present time, regulated by the terms of a treaty made between Great Britain and the United States, neither the Hydro-Electric Power Commission of Ontario, nor even the Government of that Province, is legally competent to take up the matter officially with a view to deciding what shall be done regarding the Chicago diversion, and Sir Adam Beck has, therefore, referred the Commissioners of the Chicago Sanitary District to the Dominion Government.

THE SALE OF "HEAT."

The subject discussed at the Salesmanship Conference of the British Electrical Development Association, on November 16th, was "How to Sell Heat, and Problems Related to the Warming of Air and Body." Mr. A. F. Berry (British Electric Transformer Co., Ltd.), read a paper on this subject, and the chair was occupied by Major H. Richardson.

Mr. Berry pointed out, in the first place, that perhaps the greatest advantage that electricity had to offer over all other heating agents, always excepting the sun, was the purity of electrical heat—the whole of the electrical energy being converted into heat energy and nothing else. For electric furnaces, fires, irons, medical appliances, &c., this purity of heat was invaluable, but he did not think that those who were selling heat and heating appliances realised the all-important aspect of this question of purity when they came to the cooking appliances, especially the oven. English food was so simple, that in its plainness and simplicity, it showed up any taint due to absorption of products of combustion when cooking. The value of good food, well cooked, could hardly be over-estimated, and, in selling heat, the offer of a prospect of better health, and all that went with such betterment, was legitimate, and went far to effect a sale. The perfect control and purity combined permitted those using electricity to effect economies in roasting to an extraordinary extent, but hygienic considerations and safety probably came first. Mr. Berry referred to a statement by Dr. Ferranti a few weeks ago, in which he had pointed out that the energy contained in gas only became available for heating after a chemical conversion process (combustion) at the point of application and that it was difficult to obtain good combustion and more difficult still to keep it good. Even it were good, bad by-products resulted, and if it failed in any way the by-products produced were most deleterious. Electrical energy was directly available for all services without any chemical conversion process, and for all heating purposes it gave a full return of 100 per cent. Electricity could not be made inefficient by misuse. Emphasising the importance of considering the purchaser's needs in selling heat, Mr. Berry pointed to the necessity for ensuring continuity and efficiency or economy of supply, and for striving for low first cost of apparatus with some industrial forms of heating, as well as reliability and efficacy. He also pointed to the adaptability, convenience, safety, and cleanliness of electrical apparatus.

Commenting on the importance of showing the goods properly, Mr. Berry said he was appalled at the manner in which electric fires were too often shown to would-be customers. Ill-placed, with the dust of ages upon them, flexible cords littered about, imitation oil can ornaments bent sideways, feet pin-toed, on uneven floors, &c. He really thought the electrical fire of to-day could claim to be sold in spite of the way it was shown rather than because of it. To try and sell a fire by showing it cold was like trying to sell a picture frame without the picture. The better the design of the fire, the greater the need for showing it well.

Mr. Berry then dealt with the fallacy, in heating rooms, of giving so many watts per cubic foot. With the better types of fires, he said, in which roughly 50 per cent. of the heat was in convected form and 50 per cent. was radiated, it depended very greatly on the design as to whether the people in the room got a great deal of benefit from the convected heat or none at all; more often, perhaps, than not, the convected heat went straight to the ceiling This again necessitated consideration of the specific job. He expressed the opinion that electricity supply undertakings had scarcely scratched the surface of the great field of activities crying out for cultivation.

As to warming the body, he said that ten years ago he had mentioned the fact that, after determining the amount of energy required to keep one comfortably warm in a room, he was surprised to find that 25 watts properly applied to the body gave an effect that 2,500 watts in an ordinary radiator could not well compete with. Mr. Berry referred to the warming of airmen's clothes in this connection.

Discussion.

Mr. S. T. Allen (Wolverhampton), emphasised the importance of showing apparatus in working condition, and urged supply authorities to supply electricity for demonstration purposes at a very low rate.

Captain Donaldson referred to the tendency to follow custom, and to put an electrical heater in the ordinary fireplace. He maintained that the proper position for a radiator was not the fireplace, because a good deal of heat went up the chimney. He mentioned a particular house which was built, costing about £1,500, in which something like £80 was saved through leaving the fireplaces out of bedrooms. The convenience of portable fires was stressed. He had obtained figures as to the cost per hour of a coal fire, and they had varied about 1,000 per cent.; in the case of gas fires, the confusion was even worse, but the cost per hour of electrical heating was known. The radiant heater was not always the best thing to sell, and it was really surprising what could be done for continuous heating with low-temperature heat. The effect was good, and the consumption low, and it reduced the heating peak load for the supply authority.

Mr. W. Riley emphasised the importance of manufacturers advertising in the lay Press, with a diagram if necessary, but certainly an illustration, and salient points.

Mr. W. R. Rawlings said that houses should be warmed by coke or anthracite to a small degree, and there should be electric fires in each room as well. He opposed the practice of carrying fires about, because people would not use them; there should be one in each room as far as possible. As to forms of heating, we wanted radiant heat primarily; convected heat was little use in a house. He also urged low rates for electricity for demonstration purposes.

Mr. W. A. Gillott pointed out that if it was endeavoured to sell an idea the goal would be reached more quickly than by saying a certain apparatus would cost so much per hour. Referring to cost, he said that a fairly safe figure for general domestic heating was 400 kWh per annum for every kW installed.

Mr. C. Napier Prentice said that radiant heat seemed most efficient in the majority of cases, because, with convected heat, there was often waste through the heat going up to the ceiling. As to current for demonstration purposes, he had found it effective to charge the ordinary heating rate to contractors, but to give them, as a bonus, a certain proportion of the amount of current used.

Mr. L. L. Robinson (Hackney), dealing with the position of fires, said he had a fire of the "camouflaged coal" variety, and had found that, with its nicely arching back, and real radiant heat thrown across the room, it was not necessary to close the chimney, which was useful to an extent for ventilation. Again, if in front of the window, there was ever so little heat, in the form of radiant or convective heat, in order to stop the draught, it would save a greater amount of heat being used in other positions In his office, by using 200 watts under the desk, he could do with 500 watts in the fire, and altogether, he could do with 700 watts, what he had done previously with an average of 2 kW. With regard to water heating, he urged that attention should be directed to the evolution of a thermostat with a working range electrically from 130 to 150 deg., and which would not mind being boiled. It would be a very valuable instrument, and he believed it could be evolved.

Mr. Lower (Norwich), stated that the medical profession had been of the greatest assistance to the gas industry, and he suggested that the electrical industry should try to get articles on electric heating, written by leading physicians, into the Press.

Mr. Robinson said Mr. Lower did not appear to realise why doctors recommended gas fires.

Mr. S. T. Allen referred to a case in which a doctor had directed that electric heating should be dispensed with in the bedroom of the patient, and a coal fire substituted, because the former had a bad effect on the air. As to radiant and convected heat, a cold room could not be heated quickly with radiant heat. Heat should not be allowed to get up to the ceiling in the first place. He had made experiments with a 3-kW heater and a small fan, the latter to throw convected heat down and spread it all over the room, and had found an enormous difference.

Mr. Berry, in the course of a brief reply, referred to electric heaters used under the table, and pointed out the need for diffusion.

The Magnetic Polarity of Sunspots.—At a recent meeting of the Royal Astronomical Society, a letter was read from Prof. Ellerman, who stated that it now seemed certain that the magnetic polarity of sunspots was reversed at each successive cycle. During the spot cycle that ended in 1913 it was invariably the case, in the northern hemisphere, that the eastern end of a spot group was negative and the western end positive: in the southern hemisphere it was the opposite. During the cycle 1913-1923 this state of things was reversed in both hemispheres; but now in this last year, with the beginning of the new cycle, the polarity had returned to what it was before 1913. Professor Newall said that this discovery would require a complete revolution in sunspot theory.—*Morning Post.*

The Working Shift in Germany.—Speaking at the recent meeting of the Welter Electricity and Lifting Appliances Company, of Cologne, one of the directors is reported to have stated that although there were plenty of orders on hand, it was urgently necessary to reach a more intensive working method in order to continue to be competitive with other countries, which were able to produce much cheaper. It was also essential to increase the efficiency of the workman, as it was impossible to manage with the eight-hour day, and the situation in this respect would have unconditionally to be cleared up within a short time. It was further stated that unless the labour conditions soon underwent a change in the direction of increasing production, it would be necessary for the German works to shut down.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

"J. & P." Wiring System Improvements.

Among the innovations shown in a new catalogue describing the wiring system evolved by Messrs. Johnson and Phillips, Ltd., Charlton, S.E.7, is the bonding bridge illustrated in fig. 1. This fitting has been designed for back entry cables, and it is made specially for attachment to the bonding

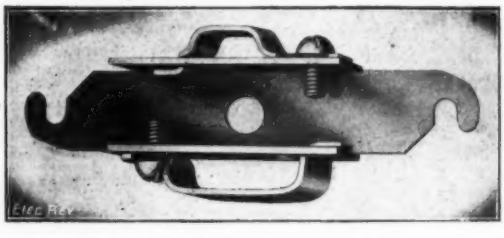


Fig. 1.—"J. & P." Bonding Bridge.

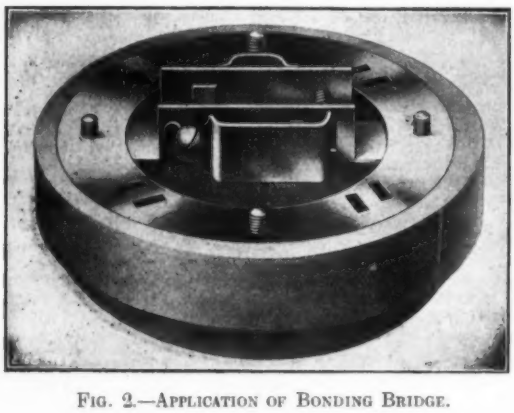


Fig. 2.—Application of Bonding Bridge.

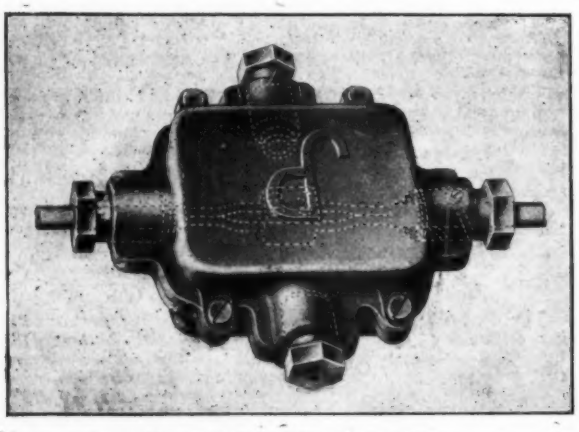


Fig. 3.—Watertight Joint Box.

ring employed in the system as shown in fig. 2. It will also take all sizes of bonding clip, one of these being shown in fig. 2. Another new fitting is the watertight joint box illustrated in fig. 3. This example is a 3-way box made of best quality grey cast iron. To facilitate jointing, the box is made in halves, and the joint between the two portions is machined to make the box watertight. The cable entries are fitted with stuffing glands packed with fine lead wool.

"Rustofite."

We have received from the Rowe Chemical Co., of 13a, Newbury Road, London, E.4, a sample of the transparent rust preventer, which the company is now manufacturing in bulk. The liquid is non-inflammable, and it is claimed that it preserves a bright finish on all ferrous and non-ferrous white metals under adverse conditions of storage, transit, and use. It is called a "metal impregnant," and is said to be unlike paints, lacquers, or varnishes; only a thin film is required, and the cost of protection against rust is said to be less than one farthing per sq. ft. We have tried it on a small scale, a bright steel article being covered with rust in a few days except where it was protected with "Rustofite," that part remaining untarnished.

PARLIAMENTARY NOTES.

(By Our Special Parliamentary Reporter.)

Electricity Supply at Cleethorpes.—On November 15th, Mr. F. Hall asked the Parliamentary Secretary to the Ministry of Transport if he was aware that the Cleethorpes Urban District Council, being faced with the necessity of providing a further supply of electricity, had made proposals for the generating of this supply by means of oil-driven plant as a temporary expedient, pending the termination of an agreement with the local tramway company; that the Urban District Council had shown that this scheme would be more economical than a scheme of supply from the Grimsby Corporation; and that the Department had refused to sanction the Urban District Council's scheme; and whether he would have this matter reconsidered, and arrange for a deputation from the Urban District Council to be received, in order that the question might be fully discussed.

Lieut.-Col. Moore-Brabazon said that the Electricity Commissioners caused a local inquiry to be held into the application at which evidence was given on behalf of the Grimsby Corporation as to the terms on which that Corporation would be prepared to give a bulk supply. It was not proved, to the satisfaction of the Commissioners, that the establishment of a small generating station by the District Council would, from the point of view of consumers in Cleethorpes, be more economical than taking a supply in bulk, and the Commissioners refused their consent to the application.

The King's Roll.—Sir M. Barlow, Minister of Labour, informed Capt. Bowyer that the number of disabled ex-service men employed by firms in Great Britain, on the King's National Roll, was approximately 330,000, after making due allowance for the employés of firms which had not renewed their undertakings. 1,317 local authorities in Great Britain were on the Roll, and 61 others had promised to enrol. This left a balance of 2,442 authorities, the great majority of whom, however, owing to the smallness of their staffs, and the infrequency of vacancies, found it difficult to qualify.

"Tube" Developments.—On November 15th, Lt.-Col. Moore-Brabazon, replying to a question by Mr. R. Morrison, said he was not aware that there was any proposal by the London & North-Eastern Railway to extend the tube north of Finsbury Park, nor was he aware that there was any other company which was prepared to do so. The whole question of the improvement of railway communications in the area, was receiving close attention from the railway companies concerned who were acting together in the matter, and the electrification of certain of the lines was contemplated at an early date.

Empire Wireless Services.—On November 15th, the Postmaster-General, in answer to Sir Harry Brittain and Sir Burton Chadwick, said that negotiations as to Empire wireless services had been conducted with the Marconi Co., on the basis of a pooling arrangement for the Imperial services as between the Government and the company. Those negotiations reached a point at which there appeared to be every prospect of a successful issue, but the company subsequently declined to proceed with them. He was still ready to enter into an arrangement on those lines but, alternatively, he had informed the company that he would be ready to grant it a licence, on terms to be agreed, for conducting all Imperial services, other than those with Canada and South Africa, which would be conducted through the Government station in this country. From discussions which he had with the representatives of the Canadian and South African Governments recently in London, he was satisfied that this arrangement would meet the requirements of those Governments.

Workmen's Compensation Act.—Before Parliament dissolved on November 16th, the Workmen's Compensation (No. 2) Bill received the Royal Assent.

The Tata Guarantee.—Mr. Barnes asked the Secretary to the Treasury whether the guarantee of £1,000,000 had been granted to the Tata Power Co., under the Trade Facilities Act, in connection with certain construction work in India, and, if so, would he state the proportion of this sum which would be spent in Great Britain on machinery.

Col. Walter Guinness, in a written reply, stated that the answer to the first part of the first part of the question was in the affirmative. It was estimated that there would be spent in Great Britain a sum of at least £900,000, which included freight and insurance in respect of transport to India, and also interest on the loan during the constructional period.

CHEAPER CABLES FOR RURAL ELECTRICITY DISTRIBUTION.

By A. HUGH SEABROOK.

The Electrical Review is rendering a great service to the industry by drawing attention to what is being done in other countries to reduce the cost of cables in rural districts in order that a reasonable return may be earned on the capital spent. The "thinness" of rural areas as compared with urban and industrial areas necessitates the utmost economy in capital. The Review published some time ago what is being done in Canada, and last week a description of a system proposed to be adopted in France.* It is significant that in both cases the single-phase system has been employed, and in the system that is being put down at present in this country, devised by Messrs. Henley's and myself, we came to the conclusion at an early stage that single-phase was the only method of reducing the cost for thinly populated areas. We have got down to a cost of approximately £500 per mile for an underground cable system, capable of carrying 500 kW and an overload up to 700 kW. In this system we use two copper conductors, but if only the powers-that-be can see their way to facilitate the use of a single conductor and the earth or copper uninsulated return, immense possibilities are opened up. At £500 per mile it is a commercial proposition, but at £350 or £400 per mile, which would be the cost if we were able to drop the second copper conductor and use the methods of construction put into force and recommended in other countries, the price per unit to the consumer could be so much lower that an enormous business could be done in areas that at present are pretty hopeless under standard conditions of supply.

As in the other cases, we have come to the conclusion that 11,000 volts is the most suitable pressure for this class of work, as it is about the highest pressure that can be "stepped down" in one transformation to consumers' pressure. The size of the cable is also important, inasmuch as such areas do not require more than 500 kW in one route. It is better when one route is loaded up to put down another cable along another route and cross-connect rather than put down an excessive kilowattage in one cable.

The overhead iron wire construction proposed in France is interesting because we find that using a copper conductor of the necessary tensile strength entails putting more kilowatts along the route than are required. A steel or composite conductor with lower conductivity and higher tensile strength would probably lower enormously the cost of extra-high-pressure distribution, particularly if an uninsulated return can be used.

The problem is totally different from that of the urban and industrial areas. In those cases heavy powers have to be transmitted, and the cost of transmission cable is a comparatively small matter, whereas in "thin" areas it is a first consideration. In Marylebone and West Ham, the cost of cables never entered into our calculations. The consumption was so great and the consumers so close together that one would never think of using anything but high-powered polyphase cables for such work; but because such a system is suitable for such areas, it does not by any means follow that it is suitable for rural districts; and, in fact, it is not. The urban and industrial areas are pretty well taken care of now on standard lines, but one need only look at the map to see what a small percentage of the total area of this country is urban and industrial, and the sooner we tackle the rural areas the better for the rapid development of the electrical industry. I sincerely trust that the Review will continue hammering at this problem, because I believe it is the biggest now open to be tackled on comprehensive lines.

I think it will be found that the single-phase system shows advantages not so much in the actual cable system as in the control, switching, and transforming. On the system we are putting down it would be practically impossible to use three-phase on account of the switching, boosting, and so on being multiplied by three as compared with the single-pole, single-phase. It is very striking on going into the subject closely to note the low cost of sub-stations on these lines compared with standard three-phase, and as capital cost is everything, we cannot afford to overlook a single point; but is there any demand in rural districts for any other than single-phase? Unity-power-factor motors can be obtained in large sizes, and there are now special designs of the ordinary single-phase motor that enable it to approach very nearly in cost and efficiency the standard three-phase motor. This is a point that requires full consideration in dealing with rural electricity supply, and I think those who look into it carefully will find there is really no advantage in employing three-phase.

It seems hardly necessary, but one is compelled to point out that, because one advocates single-phase for a certain purpose, one should not be considered to advise single-phase for everything. Single-phase, polyphase, and direct current all have their uses; it is very foolish nowadays to dogmatise on any particular system and suggest that it is suitable for all purposes, and I am very anxious not to be mistaken in this respect.

* "Rural Distribution of Electricity with Return by Earth."—Elec. Rev., Vol. 93, p. 758.—Eds.

LEGAL.

British Thomson-Houston Co., Ltd., v. British Insulated and Helsby Cables, Ltd.

The opening stages of this case were reported in our last issue.

Sir Arthur Colefax concluded his speech on November 14th, when it was stated that his Lordship, accompanied by one counsel and one expert from each side, would be given the opportunity of viewing plaintiffs' process from the powder to the filament. Sir Duncan Kerly said he would reserve the right to ask his Lordship to inspect defendants' process, and the hearing was adjourned until the following day.

At the resumption, Dr. Otto Oberlander, consulting chemist for plaintiffs, said that he had practised in England since 1906. He first commenced work in connection with tungsten filaments in 1906, and he had been consulting chemist to the General Electric Co. in respect of lamps and filaments. The first incandescent lamps had platinum filaments, but they did not prove a success in practice, because platinum had to be heated so high that it was always near melting point, and the lamp failed. The witness reviewed the progress of the incandescent electric lamp, tracing the development of platinum, carbon, osmium, and tantalum filaments, and leading up to the invention of the squirted tungsten filament by Just and Hanaman in 1904. This was the first practical tungsten lamp put on the market, although people had previously been looking for a method of obtaining a tungsten filament or a filament of some other metal. Hundreds of people were working on these lines. The process of making the squirted filament lamp was identical with that of the osmium lamp, subject to some slight alterations owing to tungsten possessing different properties. The filaments, however, were brittle, and they were held together by the fretting or sintering operation. The filaments could not be bent without breaking. In putting them into lamps, a considerable number were invariably broken. It was necessary to make 15 to obtain ten suitable for insertion in the lamp, but notwithstanding their delicate condition, hundreds of millions were sold. As soon as drawn tungsten wire became available, the manufacture was gradually changed over to lamps with drawn wire tungsten filaments. This was in 1911 and 1912. Witness added that it was really the greatest asset of tungsten (its high melting point) which made it so difficult to arrive at a satisfactory filament. Whenever an ingot was obtained, it was impure and even more brittle than the tungsten powder from which it had been made. The powder, however, could to-day be melted into an ingot. He saw that done last September, and could produce an ingot. That was the first time he had seen it done. Tung-

sten, he added, was highly oxidisable, and if a light was applied to it, oxidisation would result.

Dr. Oberlander illustrated this by applying a light to a small quantity of the powder.

Counsel: Do you know of any case in which drawn tungsten wire was ever made before 1909?—No.

Do you know of any case in which drawn tungsten wire, which was ductile cold, was known before 1909?—No, I do not.

Until the specification was published, was either of these bodies known?—No.

Answering his Lordship, witness said they were not publicly known, although he knew of drawn tungsten wire early in 1910.

Asked by counsel to explain the British Thomson-Houston patent 21,509, of 1906, witness said that the specification suggested the production of bodies of tungsten which were suitable for being drilled or filed or otherwise worked into suitable shapes. Eventually these bodies were heated to 1,600 degrees C. in order to eliminate impurities. Witness saw nothing relating to the 1909 patent, and from his knowledge of the art at the time he was certain that what the inventor had produced was nothing but a tungsten carbide, which was more brittle than tungsten and correspondingly more unworkable. In his opinion it was impossible that a body could be obtained by heating to 1,600 degrees C., as described, which could be worked.

Dealing with the B.T.H. patent 21,513, of 1906, in the specification of which it was stated that when tungsten was heated remarkable molecular changes took place, and it became so ductile that it could be worked, witness did not agree that the molecular changes took place, because on cooling he found that the tungsten was unchanged. He had photomicrographs which proved this. Tungsten could not be easily worked while hot.

After the visit of his Lordship accompanied by one expert and two counsel from each side to the works of the General Electric Co., Ltd., at Hammersmith, the examination of Dr. Oberlander was resumed on November 16th.

Asked as to the 1906 specification, 21,513, witness agreed that setting aside the information that tungsten could be worked hot, and the information given for making a slug, he did not find anything in the document likely to help him, as a chemist, to work tungsten down to a filament.

Counsel: When we come to the 1909 specification, you will call my attention to the directions that are given to avoid oxidisation?—Witness: There is a direct warning in the 1909 specification.

Is that a vital matter in obtaining a body of tungsten which is to be worked down to a filament?—It is most important in the case of a filament obtained at the date of this patent, which, as far as I recollect, always contained a considerable proportion of oxide. The material we have seen this morning which is reduced under different conditions is comparatively, if not entirely, free from oxide.

When you say "this patent," which are you referring to?—The 1906 patent. The only tungsten I knew at the date of the 1906 patent was a black amorphous tungsten.

Counsel: In the case of tungsten made in accordance with the 1909 specification, does the ductility increase or decrease when working?—It increases. The more you work the tungsten the more easy it becomes to work.

Do you find any such direction or indication in the 1906 specification?—None whatever.

Is there anywhere in the 1906 specification any directions which would enable you to get tungsten ductile cold?—No.

Witness was asked as to the Siemens and Halske specification 3,174, of 1907, and said that the process aimed at the production of ductile tungsten without mechanical working. It really amounted to a consolidation of a tungsten powder in a tube of ductile metal into which it was suggested that tungsten powder should be hammered. All it amounted to was to produce something which, after the tube had been eliminated, could be heated and so represented as being ductile suitable for working. In his opinion, such a body, if it ever could be obtained, could not be ductile.

Have you attempted to make a tungsten body by means of that specification?—I have, but as soon as you remove the cover or shell which holds the tungsten temporarily in position it does look coherent until you try to handle it. Immediately you do that it falls back into powder. By the process they had seen that morning, he added, tungsten was made to cohere so that it could be handled and subsequently worked. Even with that process the body obtained was very delicate.

As far as the specification 3,174, of 1907, is concerned, you know of no process whereby you can produce a tungsten body capable of being worked?—No; I should say the suggestion has never been acted upon.

Dr. Oberlander said the Siemens & Halske specification 4,814, of 1907, was essentially on the same lines. His criticisms were substantially the same. The British Thomson-Houston specification 16,530, of 1907, provided for the application of heat to an already continuous filament of tungsten. Heat had to be applied for the purpose of producing a spiral tungsten filament. It pre-supposed the existence of a tungsten filament. That part of the specification which alleged that tungsten an inch thick could be rolled and drawn at a temperature which was below visible redness in the open air for the purpose of rendering tungsten ductile was inoperative. It was generally believed at the time that it was unsafe to deal with tungsten above the oxidising temperature.

Answering Counsel, witness said that the process for the application of pressure, and consolidation by application of heat which was demonstrated to his Lordship that morning, was, as far as he knew, absolutely new, and it was in general use to-day.

Counsel: Is the process which was demonstrated this morning a process which follows throughout the description given in the 1909 specification?—Yes.

Witness was questioned in detail as to the plaintiffs' process, and agreed that by repeated mechanical working, the tungsten being heated during the earlier stages of the operation, a condition was reached where the metal acquired such physical or molecular characteristics that further working might, if desired, be continued at room temperature. The tungsten so treated was so ductile as to admit of bending, rolling, drawing, or the like either at ordinary temperatures, such as 20 deg. C. or hot as might be preferred.

At the resumption on November 19th,

Mr. Gray stated that in their particulars of infringement plaintiffs complained of the sale by the defendants in or about December, 1922, to the Sturdy Electrical Co., Westbourne Grove, of twelve 200-volt, 60-watt electric incandescent lamps, the filaments of which were constructed in accordance with plaintiffs' patent. Witness produced two of the lamps in question, and said that in addition he had been supplied with a reel of wire which had been received from the defendants.

Sir Duncan Kerly admitted that they were defendants' lamps.

Witness added that he had received 12 lamps from plaintiffs similar to the one in question. He analysed the filaments in some of the lamps and found that the material was drawn tungsten wire, the tungsten being substantially pure.

Counsel: Did you examine the wire microscopically?—Witness: Yes. I found that it is a typical specimen of drawn tungsten wire, such as we describe as ductile at ordinary temperatures.

From your knowledge and experience in the drawing of tungsten wire, have you arrived at a knowledge of how it was made?—Yes. I have reported to the solicitors that, in my opinion, these lamps which contain drawn tungsten wire ductile at ordinary temperatures are made in accordance with the description in plaintiffs' specification.

Have you any doubt about that?—None whatever. He added that both in the raw material used and in the working of it the process as described in plaintiffs' specification was used.

Cross-examined by Sir Duncan Kerly, witness said that he inferred from the fact that the wire in the lamp was of ductile tungsten that it had been treated by repeated mechanical workings at high temperatures.

Your view is that it must have been either hammered, rolled, or swaged until it became sufficiently small to be drawn, and then it must have been drawn at a high temperature?—We know that the drawing is not carried out at a very high temperature at the initial stage.

Counsel: Am I right so far?—Yes.

Dr. Oberlander agreed that the wire was first drawn at a temperature of 1,300 degrees, and later at 650 degrees or less. He added that he had been retained by the B.T.H. Co. as consulting chemist since 1910, and perhaps since 1909, and he had been connected with each of the actions which had been brought on different patents with regard to the preparation of electric lamps within the last ten years.

Counsel: From 1911 down to the recent action in the Scotch Court no steps had been taken effectively to prevent the manufacture under what you say is the 1909 patent?—Speaking from my own knowledge, I was instructed and I was pressed to carry on my experiments, and my experiments in connection with the action against the Duram Co. were completed when I was informed that the Duram Co. had asked the plaintiffs for a licence about two years ago.

If Dr. Coolidge ever got a tungsten wire in 1906, you say he could not have got it by following the directions in that specification?—Witness assented, but added that Dr. Coolidge would never give anything else than an honest description. All Dr. Coolidge did was to inform the Patent Department of something he had done and the rest was done in the Patent Department.

The hearing was resumed on the following day, when, in reply to further questions by Sir Duncan Kerly, witness agreed that there was a range of temperatures within which tungsten was plastic, and if heated to within that range and then worked, it developed a fibrous condition. That fact would be taught to present-day students, but it was entirely new in 1909.

Counsel: You say tungsten needs no annealing?—That is so.

Is it not the case that you can draw all metals in just the same way without the necessity of annealing, if your steps are sufficiently small?—I cannot tell. I should have said that in

all other metals, whatever the steps, somewhere you will have to anneal.

Witness repeated that at the date of the patent nobody believed that tungsten could ever be drawn into anything of a coherent nature.

Dr. Oberlander said he was aware in 1913 that the 1906 patent was unworkable and useless, and he advised counsel to that effect. Counsel, however, put a certain interpretation on one of the claims and on that they wanted to fight the broad issue.

Counsel: Certain amendments of the 1906 specification were made in order that it might be sued upon as a useful document setting forth a novel invention?—That was done on Counsel's advice; yes.

The hearing was again adjourned.

Spencer v. London Electric Railway Co.

In the Chancery Division, on November 16th, Mr. Justice Romer had before him a motion in this action to restrain the defendants from using their workings in such a way as to damage the plaintiff's house at Hendon. Mr. Farwell, K.C., for the plaintiff, said that his client was a lady who was the owner of the house in question, and the defendants were the constructors of a tube in that locality. Though the defendants' workings were some eighty feet away from the plaintiff's house, the house had suffered great damage, so much so that she had been obliged to go elsewhere to live. Defendants had claimed to be entitled to continue the works under their statutory powers, but his (counsel's) contention would be that they ought to take ordinary precautions to prevent damage to the property in question. Only the previous week the ceilings had fallen, and the place was now practically derelict.

His Lordship: The most you can do is to get an injunction not to continue without taking a reasonable amount of precaution.

Mr. Farwell: I should suggest that the matter should stand over for the surveyors of each side to consult as to a reasonable amount of reparation. It seems that the defendants have finished the work which is dangerous, and that the rest of it will be confined to the inside of the tube, and the cost of reparation would not be large.

Mr. King, for the defendants, said he could not object to such an arrangement, but there had been previous similar consultations which had been fruitless.

His Lordship allowed the matter to stand over for a week.

Reeve and Another v. Victoria Garage and Electrical Co., Ltd.

In the King's Bench Division, on November 15th, Mr. Justice Rowlatt heard a motion for judgment against Victoria Garage and Electrical Co., Ltd., by Mr. Reeve and Mr. Attey, two officials of the Motor Trade Association. It was stated that the action was brought to recover a block which was handed to the defendants when they became members of the Association. It was part of their agreement with the Association that they should return the block on leaving the Association. The block was utilised for stamping notepaper by which certain privileges were obtained from the trade. The defendants had left the Association, and had not returned the block.

In default of any appearance for the defendants his Lordship entered judgment for the plaintiffs, with costs.

Wireless Apparatus Orders.

In the Bow County Court, on Friday, before Judge Snagge, George Robert Judge, of 709, Romford Road, Manor Park, wireless apparatus manufacturer, sued H. Goater, of 41, Kempton Road, East Ham, wireless apparatus manufacturer, to recover £18 5s. 1d. for goods supplied. Sir Alfred Callaghan appeared as counsel for plaintiff, and said that a Mr. James used to call and order wireless goods from the plaintiff in the name of the Kempton Wireless & Radio Co., which company belonged to the defendant. Cash was paid for a long time, and then it was suggested that an account should be opened, to which the plaintiff agreed, and the account now sued for had run up. The defendant now suggested that James was never in his employ, and had no authority to order these goods; he, however, was not present in court.

Mr. Judge gave evidence bearing out this statement, and said that on most occasions Goater was present when the goods were ordered and taken away.

Mr. James was then called, and said he was employed by the defendant as an electrician, the defendant knowing little about the technical side of the work. He suggested what should be purchased, Goater gave him the money, and on most occasions came with him to buy. The suggestion to have a monthly account was made by Goater, and he arranged for it.

Judge Snagge: The defendant writes that in July, James was not employed by him.

Witness: Anyway I made up the sets, and Goater got what benefit there was made out of them.

Judge Snagge said there was a *prima facie* case made out that James had been held out to be the agent, and there would be a verdict for the plaintiff for the amount claimed, and costs.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Diesel-Electric Propulsion.

With reference to your comment on my letter on the above subject, in your issue of November 2nd, I fear your figures cannot have been based upon published trial results. Referring to the fuel consumption of oil engines you state that "figures as low as 0.3 to 0.4 lb. of oil per b.h.p.-hour are frequently obtained on trial."

I think I am correct in saying that the lowest figures ever recorded for a commercial oil engine is about 0.36 lb. per b.h.p.-hour.

Some misconception has arisen, owing to the fact that in my previous letter, I incorrectly quoted you as referring to consumption per i.h.p.-hour.

You ask why shipowners have yet to be convinced of the superiority of the direct-driven motor ship. Rome was not built in a day, and the history of the motor ship is still very short. Yet at the present time 20 per cent. of the tonnage of vessels building is to be motor-propelled, and of the orders for new ships placed in the last quarter, 35 per cent. were for motor craft.

No doubt, in reviewing the history of the electrical industry, you would admit the retarding influence of conservatism and ingrained opposition to all that is new. It takes some time completely to overcome this opposition. It is possible that there are still instances where gas is utilised, although electricity would be superior.

A. P. Chalkley,
London, *November 13th*, 1923. Editor, *The Motor Ship*.

[Our contention is that there are still instances where direct driving is utilised, "although electricity would be superior." We have no quarrel with the Diesel engine—only with the "retarding influence of conservatism and ingrained opposition to all that is new," such as electrical propulsion in place of gearing.—Eds. Elec. Rev.]

"Price Reductions?"

Fetch out the bunting and decorate your houses with fairy lamps, ye consumers of the County Co., for the price of energy is to be reduced—(in big black letters, it says 10 per cent., but be not too hasty!).

With paper and pencil, assisted by a slide rule, I have calculated my average quarterly saving in anticipation, and it comes to just over one shilling per quarter, and nearly five shillings per year!! Of course, the new price is 7.7 pence, meaning a reduction of 3¼ per cent. actually, and even the effect of this will not be felt until the April cheque is forwarded next year (present cost of doing this being 3½d.), which reminds me that the present price of this unit has been kept down, thanks partly to the strict internal economy of the company which cannot undertake to arrange for a collector, &c. However, I was recently assured that the County Co. doesn't charge eightpence for everything, as there *are* places in the City where there *is* competition, and there the unit charge is sevenpence!! But what an assertion in respect to a public company!

To revert for a moment to the 7.7 pence, why can't our friends stick to even farthings, if they can't afford to drop the price a whole halfpenny—the next so-called 10 per cent. reduction will bring us into two decimal places.

Consumers of the London Public Electric Light Supply Companies! What about making this question an election stunt, and getting our prospective M.P. to promise to see that the E.L.S. Companies are handled the same as the gas companies, and made to toe the line!

Southfields, *November 13th*, 1923. **F. S. Wallis.**

The Cost of Living in India.

Would any reader, lately returned from India, care to give another reader some particulars as to the cost of living and general conditions prevailing in that country? The great question is: Would Rs. 500 per month keep a man and wife in average comfort, in Bombay or Calcutta?

November 16th, 1923. **W. E. K.**

Electric Cranes.

My attention has been called to Mr. E. V. Edwards's letter in your issue for October 26th, p. 639.

I am sorry that Mr. Edwards has misunderstood the drift of my article as regards the rating of motors. While I quoted the B.E.S.A. specification for "motors having a short time rating and totally enclosed" (as being applicable to crane motors, the subject under discussion), Mr. Edwards quotes the specification for "machines (other than totally enclosed) and continuous rated," which is quite a different question.

Mr. Edwards's letter is rather typical of the ignorance of many engineers concerning the difference in the conditions

of working of intermittently operated crane motors when compared with motors which are expected to run continuously, and my regret is that my article is apparently not sufficiently explicit on this point, although I was in hopes that intelligent readers would have been able to appreciate the points of difference between continuous rated motors and short time rated motors.

I would like to ask Mr. Edwards whether he can imagine any crane motor running continuously (for six hours), and if so, what the dimensions of the shop would be for such a duty.

The Writer of the Article.

November 13th, 1923.

Telephone Licence.

The form of licence sent you by Mr. H. Moss, and printed in your last week's issue, has not, so far as I am aware, previously been published. The date of 1875, however, is obviously an error, because Bell's invention was only patented in the United States on March 7th, 1876.

Though the form of agreement was printed, the date would presumably be added in writing, and investigation will probably show that the final figure of "5" should be "8." My reasons for saying so are that, according to a statement by Bell himself, Col. Reynolds was in England "in the winter of 1877, and spring of 1878" (*The Telephone and Telephone Exchanges*, p. 89). The eighteenth day of February, 1878, would be a reasonable date for such an agreement, whilst the 18th February, 1875, would be an impossible one.

Apart from the date, however, the agreement is of interest, and a service has been rendered by its publication.

J. E. Kingsbury.

London, *November 19th*, 1923.

Wiring for "Wireless."

The following experience may be of interest to your numerous readers interested in wireless telephony.

A friend of mine, after trying different types and various circuits, desired to wire his apparatus up permanently, and so remove the loose wires, which are so much of a nuisance about gear of this kind. He did so, and used twin lead-covered wire to his loud speaker. Judge of his dismay, however, to find he had (as was afterwards explained to him) choked his loud-speaker current. It is assumed that the capacity of the lead covering had this effect, for he obtained excellent results when C.T.S. twin wire was used. He has now wired his public rooms with C.T.S., so that he can entertain his visitors in whatever room they may happen to be in by a simple plugging arrangement after the manner of portable lamps.

D. M.

Glasgow, *November 19th*, 1923.

"Strictly Home Office."

With reference to Mr. W. E. Rogers's letter in your issue of 9th inst., kindly allow me to rectify the erroneous deduction that the initials "G.P.D." and "Technical Adviser" are synonymous terms, as the statement may mislead some of your readers. The "Artic Fuses" and "Artic Fuse Elements" are made under "Ross Patents," and all designs emanate from the patentee, and are the exclusive property of the Artic Fuse & Electrical Manufacturing Co., Birkenhead. Having disposed of this assumption, I have pleasure in replying to Mr. Rogers's query and statement, regarding the undesirability of volatilising a large mass of metal when a fuse blows. This is entirely overcome in "Artic Fuse Elements" by the precipitation of the low-temperature fuse metal into special cavities, so that when the high-temperature fuse metal blows there is less than 50 per cent. of the metal to be disrupted, than would obtain if ordinary tinned copper fuse wires were used. While agreeing with Mr. Rogers that it is desirable to reduce the mass of metal to be volatilised, I consider it more important to reduce the inertia of the element, so that a definite time lag can be obtained, at a predetermined overload, and at the same time reduce the watts lost and heat generated across the element and contacts. "Artic" fuse elements embody both these features, and a definite time lag can be arranged, because the inertia which exists when No. 18 or No. 16 S.W.G. copper fuse wires or strips of metal are used is eliminated.

Referring to the fitting of fuses inside metal boxes with the box earthed, tests have been carried out under these conditions, and with the "Artic" method of throttling the arc and allowing for the expansion of the gases, any tendency to arc to earth has been prevented. If, however, Mr. Rogers wishes further to safeguard the special conditions mentioned, for laundries, chemical works, or where gases exist, he has the alternative of using enclosed fuses. For his information, I would state that "enclosed Artic elements" in ventilated "Artic self-aligning pressure-contact fuse handles" will be placed on the market at an early date, when, if he desires, we shall have pleasure in sending him samples for testing purposes. From tests which have been carried out on open types and enclosed types of elements and handles, under actual working conditions by some of the leading engineers in the country (such as the clearing of a dead short of 33,000 amperes on a 440-volt circuit), and the increasing demand for "Artic" fuses which has necessitated our expansion into larger works, we are confident that our units will withstand any condition to be met with in actual practice.

Need I add that the dimensions of our porcelain units have been arranged to comply with the B.E.S.A. specification? In the built-up indestructible type unit any dimension of hand grip or clip centres can be arranged to suit individual requirements.

Artic Fuse & Electrical Manufacturing Co.,
Chairman.

Birkenhead, *November 19th*, 1923.

"Electric Light" or "Electricity."

Might I be permitted to suggest that the E.D.A. should urge advertisers, especially those handling country house plants, to use the terms "Electricity" or "Electric Lighting and Power" in preference to the common heading "Electric Lighting (plant, or installation)."

The difference may appear trifling, but I am confident that the distinction will greatly help the trade in overcoming the prevalent misconception, among so many potential users of electricity and often their advisers, including architects, that electricity is essentially limited to lighting, and that even such items as irons and washing machines are only rendered possible by heavy expenditure and the installation of complicated machinery and wiring.

As an instance, may I mention the surprise of an eminent member of the I.C.E. when it was pointed out to him that it was quite possible to run a vacuum cleaner on his country-house installation, without any alterations or re-wiring whatsoever.

C. D. H. Dixon.

London, *November 15th*, 1923.

The Design of Tramcars.

The recent paper read by Mr. R. Stuart Pilcher before the Municipal Tramway Association has emphasised the necessity of cutting down the weight of tramway cars, but I do not consider that he has gone nearly far enough. The deplorable condition of much of the track in Britain is mainly due to the excessive weight of the cars per wheel, and it appears to be time that the whole design of the cars was reconsidered in the light of experience with other types of vehicle. In many cases, where failures have occurred, the trouble has been cured by merely increasing the weight of the part instead of by improving the design. A few suggestions with regard to the direction in which improvements in design appear possible may be given.

The wheels are made excessively heavy to resist the shock on the flanges and to allow them to be pressed on to the shafts. By designing the suspension so that side shock is taken by springs and by altering the method of attachment to the axles, the weight could probably be reduced. The axle is usually about 4 in. in diameter; compare this with the axle of a petrol-driven car. By using a floating axle and doing away with the motor yoke bearings a considerable saving in unsprung weight should be possible. This would probably necessitate the abolition of the usual straight spur gear, which is one of the most unsatisfactory parts of the present design. It is heavy and requires a heavy gear case which, however, does not permit of proper lubrication, and consequently the life is not in proportion to the weight.

The spiral bevel-type of gear might be tried, which would allow more freedom in the design of the motors, and would permit one motor to be used coupled to both axles of a four-wheel car or two motors for a bogie car. The mechanical coupling of the axles would be an advantage. If it is necessary to retain series-parallel control this might be accomplished by means of double-wound armatures or two armatures on one shaft. Is there any reason why still higher speeds of rotation of the motors should not be used, something comparable with the speeds of petrol engines? These high speeds should be obtained by field regulation, so that there would be more running positions on the controllers. The acceleration is far too uneven in many cases, and by improving this passengers would be more comfortable and repairs would be reduced. Existing trucks appear to be absurdly heavy, and lighter and stronger construction could be obtained by using channel iron or plate frames. I have never understood why the driver is condemned to stand at his work. The position is a survival of the horse-tramway days, which apparently originated when horses were first driven in chariots. A sitting position would be much less tiring and more efficient, and would allow of both foot and hand-brakes being fitted, one being applied to the truck and the hand-brake could be operated by a simple fore-and-aft movement. The usual type of brake handle is awkward and slow in emergency. The electric controls also could be improved, and I would suggest that the gate control of a petrol car could be used as a guide in designing an improved type. If the present type of entrance is used there should be no difficulty in designing the driver's

seat to tip up and the control handles to be removed when the driver occupies the other end platform.

There does not appear to be any necessity for two controllers to be used, with all their attendant cables. A single controller, fixed near the motor and worked mechanically from either end of the car, would save weight and expense. This controller might be of the oil-immersed type, and would, in any case, require to be waterproof. Resistances should be lighter and might be cooled by artificial draught, if necessary. Ball or roller bearings should be used throughout.

There are many other points about the design of cars which should be looked into, and although all my suggestions may not be practicable, there is no doubt that the whole design requires revision. The designer should have in view the whole time the fact that a tramcar is a road and not a railway vehicle. This fact makes the trying of experimental designs much easier, as a failure is not likely to result in loss of life.

It appears to be the view of some people that to cut down the weight of the truck is inadvisable owing to the centre of gravity of the car being raised thereby. It would be almost as logical to have a well-designed truck and to carry lead ballast as near the ground as possible in order to prevent the car being blown over.

My view is that the body should be so designed as to suit the most efficient truck and that the question should be seriously considered whether British practice of having top decks is better than the practice of most other countries. There is undoubtedly good reason for the unpopularity of tramcars with other road users, as it is frequently most difficult to overtake one without an accident. Would it not be possible to bring the rails to the pavement at stopping places, thus allowing other fast traffic to proceed straight on? At first sight it appears that stationary vehicles would interfere with the cars, but when it is considered that in many places the rails run for considerable distances too close to the pavement to allow vehicles to stand, this objection is not very serious; in fact it is probable that higher average speeds would be possible, as stoppages would be fewer and passengers would alight and enter more quickly.

P. G. Moore.

Cawnpore, *October 23rd*, 1923.

Ball Lightning.

The interesting case of "ball lightning" mentioned by Dr. Russell in his presidential address to the Institution of Electrical Engineers, and the article by Mr. Kilburn Scott in your issue of the 2nd inst., suggest my sending you the enclosed paper "On Thunderbolts," from the *Philosophical Magazine*, of May, 1911. The theory that ball lightning is mostly gaseous ozone, with possibly some nitrogen compounds, appears to explain the observed phenomena. Mr. Kilburn Scott's explanation is on the same line, but I doubt whether a liquid ball would float along horizontally, as Dr. Russell and many others have observed. The weight of evidence is in favour of ozone, which is heavier than air, and in reverting to oxygen gives out energy sufficient to account for the damage done.

W. M. Thornton.

Newcastle-upon-Tyne, *November 16th*, 1923.

[An abstract of this interesting paper appears elsewhere in this issue.—Eds. Elec. Rev.]

The Postmaster-General and Electrical Power and Lighting Undertakings.

I have read Mr. Bartholomew's letter appearing in your issue of the 16th instant. At the risk of further contributing to apparently interminable correspondence on this subject, I would like to offer the following observations.

My object was to draw attention to the true position of the Postmaster-General with reference to electricity undertakings, to his powers, and to his exercise thereof.

To divert attention by disputing the less important details, or calling attention to small inaccuracies or unimportant omissions, does not help matters; it simply obscures the issue.

The point as regards Section 4 of the Electric Lighting Act, 1888, whether it applies to statutory undertakers or not, is really of minor importance. In originally referring to it I was endeavouring to exhaustively set out all authorities allowing the exercise by the Postmaster-General of jurisdiction not subject to arbitration or appeal to the Electricity Commissioners. I agree that the Section referred to is not too clear, and probably it was contemplated that all necessary protective provisions would be inserted in the enabling order, and that no occasion would arise for service of any notice involving scope for interference by the Postmaster-General. But the wording of the Section does not, in my opinion, entirely exclude statutory undertakings from the possibility of being served with such notice. If the Section does not apply to statutory undertakings at all, so much the better, as so much the less scope for the Postmaster-General's autocracy. The conclusion is that only in very few cases are the powers of the Postmaster-General not subject to arbitration or appeal to the Electricity Commissioners, and my contention was that in those few cases it is the duty of the Postmaster-General to exercise that jurisdiction not arbitrarily, but reasonably, and on sound technical grounds. This is all that was contended for.

The allegation that I have "raised a fresh hare" implies that there have been former hares raised by me. All the hares and red herrings have hitherto been raised against and not by me, a pleasing but quite futile diversion. Mr. Bartholomew now proceeds to catch and cook the hare he thinks he has discovered, brought on the field by me, by producing another. What does it really matter? So long as alleged interference with the Postmaster-General's telegraph and telephone wires is to be arbitrated on, and not determined by him alone, and so long as it remains a factor whether he brought them to the trouble and thus sought it out, or not, electrical undertakings may well rest content. Thank Heaven for arbitration, as opposed to bureaucratic autocracy.

The point as regards the 20-volt drop on the uninsulated rails of the Brighton Railway is one in which I relied on a definite statement in Mr. Austin's standard book. If he is wrong, and there is no limit fixed to the drop with alternating currents, so much the more force in the argument in favour of permitting the lead-sheath return circuit.

Mr. Bartholomew's reference to the reports of "the Joint General Committee of the National Electric Light Association and Bell Telephone System on Physical Relations Between Electrical Supply and Signal Systems," on the subject of *ground* return circuits, really makes a further point against his argument. It contains the following sentence:—"This does not apply to track return circuits." Surely these are analogous to lead-sheath return circuits, and thus the report really supports the contention in favour of allowing these.

Mr. Bartholomew's comment on the Dr. Ferranti incident in the eighties of the last century, that "surely the laws of electricity governing inductive effects have not changed in the meantime," is not one which one would have expected from him. It is not a matter of the laws of electricity having changed, but one of changes and improvements in technical practice owing to greater knowledge of such laws. There must be many cases in which through increased scientific knowledge and consequent improvements in technical practice it has been found possible to discard unnecessary and excessive precautions.

The whole subject is indeed one which should be considered and discussed on broad and liberal lines, and not allowed to degenerate into petty controversies on unimportant side issues. One of the difficulties in dealing with some bureaucracies is their slavish devotion to every detail, the more unimportant sometimes the greater devotion to them, and consequent detriment to essentials. The article published in your last issue "Rural Distribution of Electricity with Return by Earth," may be read by Mr. Bartholomew with advantage. It shows that in France also the repeal of a Government regulation forbidding the use of the earth as part of a distributing circuit—at least in the case of rural areas—is being advocated, the regulation being unnecessary in view of present knowledge and improvements in technical practice, and merely existing because hitherto no one had asked for it to be repealed. The present trouble in this country is in regard to electrification in rural areas, and the difficulties being made in regard thereto.

W. H. Stoker.

London, *November 20th*, 1923.

An American Station on One Valve.—The initials "J. S." were accidentally substituted for the signature of the writer of the letter under this heading in our last issue—Mr. H. R. Taunton.

Letters too Late.—Letters have been received, unfortunately too late for insertion this week, from Mr. R. Hardie (manager of the showroom of Glasgow Corporation Electricity Department), repudiating the charges made by "A Contractor" in our last issue; from "Grid Leak" and "Old Spark" on the other side of this question; from Mr. W. Fennell on the G.P.O.; from Mr. D. V. Onslow on the reception of an American station; from Mr. E. Berry Nixon on single-core cables; and other correspondents.

Ultra-Violet Rays.—That ultra-violet rays can cure rickets, a disease of childhood characterised by softening of the bones, was asserted on November 19th before the Academy of Sciences by Prof. Richet on behalf of his colleague Prof. Laine. The latter, who experimented upon 60 rickety children, states that the patients improve rapidly under this treatment.—*Daily Mail.*

The Deterioration of Structures in Sea-water.—The Committee of the Institution of Civil Engineers which is studying this subject has prepared a third interim report, which has been issued by the Department of Scientific and Industrial Research (H.M. Stationery Office, price 3s.). Besides the corrosion of metals, the report deals with the destruction of timber by animal pests, and it is stated that treatment with an exceedingly weak solution of phenarsazine entirely prevented the teredo from penetrating blocks of timber. Particulars are given of the experiments, which may prove useful to the manufacturers and users of submarine cables.

BUSINESS NOTES.

Bankruptcy Proceedings.—Percy P. Kennedy (trading as Martin & Co.), 102, High Street, Stoke Newington, electrical engineer.—The first meeting of creditors was held on November 14th at the London Bankruptcy Court. Mr. F. T. Garton, Official Receiver, reported that the debtor had stated that from 1898 to 1907 he was employed by Mr. Martin, who traded as an electrical engineer at the above address. The business was purchased in 1907 by another person, whose son joined him (debtor) as a partner. They agreed to pay the father £450 by instalments, and had carried out the agreement. The business was continued without interruption at the same address, but it was always short of capital. The partner was killed, whilst on active service, in December, 1915; the debtor paid the widow 25s. a week for one year, and subsequently gave her £130 in settlement of the partner's interest. He had since traded alone, but business had been very bad during the last two years. He had tried to obtain a partner, but without result. Creditors had pressed for payment, and an execution had been levied by one of the number. He filed his petition on October 30th. The liabilities were estimated at £650, against assets valued at £190, made up of stock estimated to realise £40, machinery, &c., £5; safe, office table, &c., £20; household furniture, £10; book debts, £500, valued at £100; and life policy, £15. Bad debts and slackness of trade were the reasons assigned for the failure. A resolution was passed for Mr. W. A. J. Osborne, accountant, to wind up the estate in bankruptcy. The following are creditors:—

	£		£
Curtis & Harvey, Ltd.	23	T. Kennedy	100
Falk, Stadelmann & Co., Ltd.	149	Sloan Electrical Co., Ltd.	81
General Electric Co., Ltd. ...	117	Wholesale Fittings Co., Ltd. ...	23

Emmett & Co., builders, gas and electrical engineers, 249, Goldhawk Road, Shepherd's Bush, W.—Receiving order made November 12th on creditor's petition. First meeting November 23rd. Public examination March 12th; both at Carey Street, W.C.

J. A. Hillier, electrical engineer, 58, Trafalgar Terrace, Swansea.—Receiving order made November 12th on debtor's own petition. First meeting, November 29th, at the Official Receiver's office, Government Buildings, St. Mary Street, Swansea. Public examination, December 21st, at the Town Hall, Swansea.

S. B. Weston (Westforrest Radio Co.), wireless apparatus manufacturer, Utworth Manor, Cranleigh, and Playhouse Arcade, High Street, Guildford. First meeting November 23rd at 29, Russell Square, W.C. Public examination December 4th at the Guildhall, Guildford.

D. H. Griffen (Midland Electric Co.), electrical engineer, 5, The Mart, St. David's Road South, St. Annes-on-Sea.—First and final dividend of 1s. 9½d. in the £, payable November 23rd at the Official Receiver's offices, 11, Winckley Square, Preston.

Francis Bertram Thorpe, 1, West Laithe Gate, Doncaster, electrical engineer.—The public examination of this debtor was held on November 15th at the County Court Hall, Bank Street, Sheffield. The statement of affairs showed liabilities of £842, against assets of £792. Debtor attributed his failure to shortness of capital, small profits and losses on contracts. It appeared that he traded successfully from 1911 to 1922, but trade latterly declined. He had made an offer to the creditors of a composition of 12s. in the £, and this had been accepted. The examination was formally adjourned that an application might be made to the Court for approval of the composition scheme. The following are creditors herein:—

	£		£
F. Bartlett & Co.	27	Falk, Stadelmann & Co., Ltd. ...	12
British Thomson-Houston Co., Ltd.	11	Robert Farr & Sons	12
George Casperson	11	Foster Engineering Co., Ltd. ...	37
J. F. Cater	22	General Electric Co., Ltd. ...	28
J. Dyson	48	H. & G. O. Lewtas	14
S. Eaton & Sons	10	Mining & General Stores, Ltd. ...	76
Electrical Specialities Co., Ltd.	22	Oldham & Sons, Ltd.	20
Electric & General Stores Co., Ltd.	194	Rhodes Motor, Ltd.	12
Electric Lamp Factors, Ltd. ...	24	Simpson, Baker & Co.	18
English Electric & Siemens Supplies, Ltd.	13	St. Helens Cable & Rubber Co., Ltd.	17
		G. C. White	16

William Nassau Walters, 355, Finchley Road, electrical engineer.—The public examination of this debtor was held on Tuesday, before Mr. Registrar Mellor, at the London Bankruptcy Court, the accounts showing liabilities £442, against assets, nil. Replying to Mr. D. Williams, Official Receiver, the debtor stated that he was born at Malta, and joined H.M. Navy in 1888. He was discharged in 1910, with the rating of chief armourer, and was awarded a pension of £97 4s. per annum. He then commenced business as an electrical engineer at 83, High Street, Gosport, but served with the Naval forces during part of the war, and was discharged at his own request in 1917, in order that he might resume his business at Gosport. Early in 1920, he was joined in that business by a Mr. Wilson, who contributed £1,000 as capital, in exchange for a one-half share of the profits; about the beginning of 1921, he sold his interest in the business to his partner for a further £3,000. In May or June, 1921, witness opened premises at 355, Finchley Road, as an electrical engineer, trading as the Hampstead Electrical Co. (proprietor, W. N. Walters). The business was converted in October, 1921, into a limited company, with a nominal capital of £1,000, in £1 shares, of which he was allotted 500 as vendor. 500 were issued to a gentleman who subscribed £200 in cash. The company was not successful, and on February 15th, 1922, he purchased the before-mentioned gentleman's holdings for £200. Shortly after the company commenced operations, one of his employés sustained a serious accident, and an action for compensation was successfully brought against him. Owing to bad trade, witness borrowed from a professional money-lender on October 17th, 1922, and being unable to repay the loan these bankruptcy proceedings were instituted. Witness attributed his failure and insolvency to the non-success of the Hampstead Electrical Co., Ltd., and to the action brought under the Workmen's Compensation Act. The examination was concluded.

Company Liquidations.—Sanders, Kennedy & Co., Ltd., Apex Works, Burnham-on-Sea, electrical engineers.—Pursuant to Section 188 of the Companies (Consolidation) Act, 1908, a meeting of the creditors in this matter was held on November 14th at the Grand Hotel, Bristol, when the liquidator of the company, Mr. F. J. Sully, stated that the liabilities amounted to £3,600, while the assets totalled £1,170, from which had to be deducted £120 for preferential claims, leaving net assets £1,050, or a deficiency of £2,550. The assets consisted of stock, £230; book debts, £700; cash at bank, £50; and cars and cycles, £150. It would appear that the company was formed in May, 1922, with a nominal capital of £5,000, of which 2,650 shares were issued. The trading down to February, 1923, showed a loss of £1,680. In September last a first mortgage debenture for £500 was issued in favour of one of the directors. A creditor intimated that the debenture could be upset because the company had gone into liquidation within three months of the issue. The liquidator said that the debenture holder was quite willing to withdraw his claim as a secured creditor. Eventually it was decided that the directors appoint Mr. Arthur Collins, C.A., of Bristol, as joint liquidator with Mr. Sully.

Park Royal Engineering Works, Ltd.—A petition for the winding-up of this company has been presented to the High Court by the Aston Chain and Hook Co., Ltd., of Bromford Lane, Erdington, Birmingham, creditors, and will be heard in London on November 27th.

Midland Arc Electric Welding Co., Ltd.—Winding up voluntarily. Liquidator, Mr. T. E. Clarke, 13, St. Peter's Gate, Nottingham. Meeting of creditors at the liquidator's offices, November 26th. Particulars of claims by December 31st.

Scott's Starter Syndicate, Ltd.—Winding up voluntarily. Liquidator, Mr. G. J. Scott Windgate Ade, Norfolk.

Electric Traction Developments, Ltd.—Winding up voluntarily. Liquidator, Mr. H. W. J. Vertigan, 82, Collingwood Buildings, Newcastle-upon-Tyne. Meeting of creditors at Milburn House, Newcastle-upon-Tyne, November 26th.

Dalziel's Constant Voltage Patents, Ltd.—A meeting of members is called for December 20th at 24, The Strand, Derby, to hear an account of the winding-up from the liquidator, Mr. S. Taylor Hall.

Cannon Motor & Electrical Works, Ltd.—A meeting of the company is called for December 31st at 5, Bartholomew's, Brighton, to hear an account of the winding-up from the liquidator, Mr. P. G. Clegg.

A. C. Alexandra & Co., Ltd.—Winding-up order made November 13th.

British Road Train Corporation, Ltd.—Winding-up order made November 13th.

Ewart & Collis, Ltd.—Winding up voluntarily. Liquidator, Sir W. H. Peat, 11, Ironmonger Lane, E.C. Meeting of creditors, December 4th, at the liquidator's offices.

Dissolutions of Partnership.—South Wales Gear Cutting and General Engineering Co., gear cutting mechanical, hydraulic, electrical, motor and marine engineers and welders, 79a, The Strand, Swansea.—Mr. H. Tustian, Mr. T. Griffiths and Mr. G. H. Green have dissolved partnership. Mr. Griffiths will attend to debts and continue the business in partnership with Mr. F. J. Boyd under the style of Griffiths and Boyd.

W. T. Bower & Co., electrical engineers and manufacturers' agents, 36, Cannon Street, Birmingham.—Mr. W. T. Bower and Mr. J. H. Dwyer have dissolved partnership. Mr. Dwyer will attend to debts and continue the business.

W. White & Co., electrical and mechanical engineers and merchants, Mansion House Chambers, 11, Queen Victoria Street, E.C., and 12, 13, & 14, County Terrace Street, New Kent Road, S.E.1.—Messrs. W. White, T. H. Bacon and H. Foster have dissolved partnership. Debts will be attended to by Mr. Foster, who will continue the business under the same style.

Alpha Manufacturing Co., electrical and mechanical engineers, 26, High Road, Balham, S.W., and Harberson Works,

Harberson Road, Balham, S.W.—Mr. G. F. Beare and Mr. W. Harris have dissolved partnership. Mr. Harris will attend to debts and continue the business.

P. H. BOYS & Co., electrical and wireless engineers, 187, Caswell Road, E.C.—Messrs. P. H. Boys and G. J. Irons have dissolved partnership. Mr. Irons will attend to debts and continue the business.

Receiver Appointed.—SIMMONDS BROS., LTD., Newton Street, High Holborn, London, W.C.2, exhibition stand fitters, and 310, Merton Road, Wandsworth, S.W.18, electrical engineers.—On November 3rd Sir Harold de Courcy Moore (of Moore, Stephens & Co., 2, Gresham Buildings, Guildhall, E.C.2) was appointed receiver and manager of the businesses of this company on behalf of the debenture holders. The businesses are at present being carried on, and an investigation is in progress.

Trade Announcements.—Owing to the increased business in the Sharples "Super-Centrifuge" separator, UNITED WATER SOFTENERS, LTD., has found it necessary to form a separate company to deal with it under the title of Super-Centrifugal Engineers, Ltd.

MR. H. A. PEARSON, A.M.I.E.E., who represents Messrs. Allen West & Co., Ltd., and The Reason Manufacturing Co., Ltd., in London and the South of England, has removed to 176/8, Upper Thames Street, E.C.4. Telephone number: "City 7493."

MR. D. HOOPER, of Lime Grove, Long Eaton, Derbyshire, who has commenced business as a retail agent for electrical apparatus and mechanical engineering requisites, asks for manufacturers' catalogues and price lists.

MESSRS. H. W. SULLIVAN, LTD., have recently appointed Messrs. S. Glover & Co., 13, Akenside Hill, Quayside, Newcastle-on-Tyne, their sole agents for electric fires, cooking appliances, and wireless apparatus in the Northern Counties.

MR. GORDON C. LENT, electrical engineer and contractor, of 15a, Churchill Street, London Road, Dover, asks for lists of wireless sets and parts.

MESSRS. LORD PICKARD & Co., of Exeter, state that they are not now representing Messrs. Robinson & Hands Electrical Co., Ltd., of Birmingham.

MR. F. E. FRAMPTON (Messrs. Porter Turk & Son, Ltd., electrical engineers and contractors, Bartholomew Works, Newbury) asks for catalogues of electrical and wireless goods.

MESSRS. JOHN DUGDILL & Co. have removed from Failsworth to Hazel Grove, near Stockport. Telephone No.: "2151 Stockport."

MR. HAYDN T. HARRISON, M.I.E.E. consulting engineer, has removed to 14, Victoria Street, S.W., where he will have more accommodation. Telephone No.: Victoria 3719. Mr. Harrison asks for new catalogues relating to lighting.

We are informed that MESSRS. RAYNER & HEALD, LTD., of Derby, who are at present working under a receivership, are shortly about to make arrangements for a reconstruction of the company. They propose to extend the scope of their manufactures, making use of their own facilities, and those of affiliated concerns, for producing larger sized machines up to 500/600 h.p. In this connection they have retained the services of Mr. Aubrey V. Clayton, the well-known designer of electrical machinery. Mr. Clayton was for a number of years interested in the electrical machinery and transformer manufacturing industry of Sweden, where he established the "Clayton-Unger" business, subsequently becoming chief engineer and designer to the Amalgamated Companies of Sweden, which combination absorbed his "Clayton-Unger" works. Mr. Clayton was also designer and licensee of the Holmes-Clayton alternating current machinery, formerly manufactured by Messrs. J. H. Holmes & Co. With regard to Messrs. Rayner and Heald's selling organisation, the Midland Supply Co., of 53, Summer Row, Birmingham, will act for them in England, and Messrs. Allan Irwin & Co., of 50, Wellington Street, Glasgow, in Scotland.

Catalogues and Lists.—MESSRS. LIONEL ROBINSON & Co., 3, Staple Inn, W.C.1.—An illustrated and priced pamphlet dealing with the "Ella" battery charger for a.c. circuits.

BRITISH THOMSON-HOUSTON Co., LTD., Crown House, Aldwych, W.C.2.—An illustrated folder giving particulars and prices of "Mazda" automobile lamps—vacuum and gasfilled.

FISCOL, LTD., Penarth Street, S.E.15.—Two pamphlets dealing with the firm's special electro-plating process, and giving particulars of tests carried out at the N.P.L.

THE CABLE ACCESSORIES Co., LTD., Tividale, Tipton, Staffs.—Three priced pamphlets dealing respectively with "Revo" fires, "Revo" loud speakers, and "Revophone" radio-receiving sets.

ENGINEERING SUPPLIES, LTD., 155a, Upper Thames Street, E.C.4.—Wholesale net price list of instrument wires, flexibles, fuse wires, &c.

STERLING TELEPHONE & ELECTRIC Co., LTD., 210-212, Tottenham Court Road, W.1.—Publications Nos. 353 and 375, illustrating and describing "Sterling" radio-receiving sets, loud speakers, amplifiers, and accessories.

THE ARORA Co., Rosebery Street, Loughborough.—A priced and illustrated pamphlet dealing with four types of electric fires.

FULLER'S UNITED ELECTRIC WORKS, LTD., Woodland Works, Chadwell Heath, E.—List 250 B dealing with plate and block type batteries for ignition, lighting, and radio work; and List 315 containing particulars of radio accessories, transformers, condensers, batteries, &c.

MESSRS. J. H. HOLMES & Co., Portland Road, Newcastle-on-Tyne.—An illustrated brochure describing the "Holmes-Clatworthy" system of driving rotary web printing presses.

AUTOMATIC TELEPHONE MANUFACTURING Co., LTD., Milton Road, Edge Lane, Liverpool.—A well-illustrated and priced catalogue of "Xcel" heating and cooking appliances, violet-ray apparatus, hair dryers, soldering irons, &c. Also an illustrated folder dealing with electric irons, fires, vacuum cleaners, and other appliances.

MESSRS. A. VEREY & Co., LTD., 27, Buckingham Gate, Victoria Street, S.W.1.—Trade List No. 1,150, giving net prices of radio receiving sets, components, and accessories. Also Trade Price List No. 1,200, dealing with wiring materials and electrical accessories.

Book Notices.—"Working of Steam Boilers," by Edward G. Hillier, B.Sc., M.Inst.C.E. (Pp. 166; 88 figs.). Manchester: Bethell & Co., Ltd. Price 3s. 6d. net.—This is the sixth edition of a book of instructions for the guidance of all who have charge of boilers. The author is chief engineer of the National Boiler & General Insurance Co., Ltd., under whose auspices the work is published. About a third of the volume is devoted to boilers generally, while, later, particular types are dealt with in greater detail. An examination of the work leads to the conclusion that very little (if anything) relating to boiler operation has been omitted, and an adherence to the instructions set forth should result in added efficiency and safety. A particularly useful feature of the book is the very comprehensive and detailed index, which greatly facilitates quick reference to the contents.

"Annual Report of the Smithsonian Institution, 1921" (pp. 638; 113 plates). Washington: Government Printing Office.—The actual report of the activities of the Institution occupies 134 pages of this volume; it is probably the "appendix," which constitutes the remainder, which is of the greater general interest. In this thirty papers dealing with a variety of subjects are reproduced, and among them may be mentioned "Atomic Weights and Isotopes," by Dr. F. W. Aston; and a paper on the Einstein theory of relativity by H. N. Russell. For the rest, the papers are mainly upon natural history, geological subjects, and anthropology.

Scientific Paper No. 475 of the U.S. Bureau of Standards, "Visibility of Radiant Energy," by K. S. Gibson and E. P. T. Tyndall (61 pp.). Washington: Government Printing Office. Price 15 cents.—This describes in great detail work carried out in conjunction with the Nela Research Laboratories for a new determination of the visibility of radiant energy by the step-by-step method, an equality of brightness method with little or no hue difference in the two parts of the photometric field.

"Engineering Science," by A. G. Robson. Pp. xii+201; 185 figs. London: Chapman & Hall, Ltd. Price 7s. 6d. net.

"Smoke Inspector's Handbook," by H. G. Clinch. Pp. xvi+136; figs. 59. London: H. G. Lewis & Co. Price 7s. 6d. net.

"Studies in Tidal Power," by N. Davey. Pp. xiii+255; 56 figs. and 65 charts. Price 32s. net. "Wireless for the Amateur," by J. Roussel. Pp. xiii+270; figs. 216. Price 14s. net. London: Constable & Co., Ltd.

"Wireless Telephony Explained," by J. Hartley Reynolds and G. L. Morrow. Pp. 124; figs. 110. London: Cassell and Co., Ltd. Price 1s. 6d. net.

"St. Lawrence and Southern Hudson Bay Drainage." Dominion Water-Power Branch, Water Resources Paper No. 38 (100 pp. and maps). Ottawa: F. A. Acland, King's Printer.—This report covers the climatic year 1921-22, and contains a mass of data relating to drainage, stream measurement, &c., collected systematically during the year.

Lead.—In their report dated November 17th, Messrs. James Forster & Co. state:—"The imports of pig lead for October are only about one-third of the September arrivals, and in consequence the two months combined give an average of about 14,000 tons left for home absorption. The imports this month so far are, however, larger than last, but are not likely to be up to the requirements of consumers, which continue heavy, particularly in the electrical trades."

Fire.—A Press report states that a fire occurred on Sunday afternoon in part of the Thomson-Houston works in the Rue de la Procession, Paris.

British Empire Exhibition Notes.—At a meeting of the Executive Council of the Exhibition on November 16th, Sir James Stevenson, chairman of the Board, presented a report, which stated, *inter alia*, that the whole of the space in the Palaces of Engineering and Industry had been applied for. The assistance of several of the great industrial organisations was acknowledged. The finance member of the Board, Sir Charles McLeod, said that the attendance of over 30 million visitors was anticipated.

ELECTRICAL DISPLAY BY THE E.D.A.—The vacancy for an exhibition manager recently advertised by the E.D.A. has now been filled by the appointment of Mr. W. A. Gillott, A.M.I.E.E., who is well known in the industry in connection with development work, the design and organisation of showrooms, domestic load building, and similar activities. All communications relating to the E.D.A. display should be addressed to the Director of the Association, 15, Savoy Street, as usual.

Workmen's Travelling Expenses.—The Industrial Court has decided that the men employed by Messrs. Fraser and Chalmers, Erith, upon work at the Greenwich power station for the London County Council, shall not be paid local travelling expenses of 1s. 6d. per day. The Court states that the Iron and Steel Trades Confederation, the union to which the men affected belong, has not established that it is the practice for these allowances to be paid within the area of the L.C.C. on work of this class.

Financial Facilities for Industry.—There has just been issued a statement bringing down to September 30th, 1923, particulars of the guarantees given by the Treasury under the Trade Facilities Act for works which will promote British employment. The cases now mentioned, in which principal and interest are both guaranteed for the number of years stated in parentheses, are :—

North Wales Power Co., £1,500,000 (30 years), for hydro-electric scheme in North Wales.

Bank Line, £1,800,000 (20 years), for construction of 19 motor ships at Govan.

Tata Power Co., £150,000 (25 years), for hydro-electric scheme in India (in addition to £850,000).

James Powell & Sons (Whitefriars), £7,000 (9 years), for provision of new furnace at glass factory (in addition to £50,000).

Swedish Workmen and Management.—In the proposal for a new agreement with the engineering works, the workmen put forward a claim for the introduction of a workers' share in the management of enterprises by the participation of workers in the so-called managing councils.—*Reuter's Trade Service* (Stockholm).

For Sale.—By direction of the George Cohen & Armstrong Disposal Corporation, Mr. A. H. Davis will sell by auction on November 29th, at the Hackney Marshes Factory, the remaining plant and machinery, including three 250-kW Westinghouse turbo-electric generating sets, a set of twin triple-expansion surface-condensing marine engines, three Babcock & Wilcox portable water-tube boilers, &c. (See our advertisement pages to-day.)

Hong-Kong's Import Trade.—A report upon the foreign trade of Hong-Kong during 1922 by the United States Consul-General shows that, although the United States was the largest supplier of goods generally—the United Kingdom being fifth, so far as electrical machinery and boilers were concerned, the United Kingdom held a substantial lead. The values of electrical machinery supplied by the two countries were :—United Kingdom, £126,706 (£111,843 in 1921); United States, £15,677 (£48,673 in 1921). The value of boilers imported were :—United Kingdom, £33,641 (£81,610); United States, £1,546 (£10,233).

Copper and Lead Prices.—Messrs. F. Smith & Co. report November 21st :—Copper (electrolytic) bars, £68 10s., 30s. increase; do. do. sheets, no change; do. do. wire rods, £78 10s., 30s. increase; do. do. h.c. wire, 9 13/16d., 3/16d. increase.

Messrs. James & Shakespeare report November 21st :—Copper bars (best selected), sheet and rod, no change; English pig lead, £33, 5s. increase.

New Municipal Showrooms.—The Halifax Corporation Electricity Department has opened new and well-equipped electricity showrooms in Town Hall Street East. A very fine suite of display rooms, including exhibition lounge, dining room, bedroom, bathroom and kitchen, has been fitted up, the place having been reconstructed out of the old offices and showrooms, which were on a more modest scale.

To celebrate the opening of the showrooms an electrically-cooked dinner was given to a company of 24 on November 13th. The cooking was the subject of the encomiums from all of the participants, a four-course meal being provided with a consumption of six kilowatt-hours.

It was announced that the department was giving residents an opportunity of testing electrical cooking for themselves at small cost by letting out cookers free of charge. The offer was quickly accepted and twenty other persons applied for cookers under the Department's hiring scheme.

Armature Sheets in Russia.—It is announced that the Ural Metal Trust is about to renew the production of armature sheets, the demand for which is said to have recently increased in connection with the extension of the electrification schemes. A quantity of 800 tons of armature iron is to be prepared, which is sufficient for the present requirements of the manufacturing works, and the realisation of this programme will render it unnecessary for the General Electrical Commission to make further purchases of iron from abroad.

Russian Orders for Czecho-Slovakia.—Orders for boilers and turbine installations for the four large power stations being erected near Nizhni Novgorod and Moscow have been placed with the Czecho-Slovak firms Vitkovice Iron Works and the Brno Machinery Co. The Skoda Works has added to its properties a new factory at Doudlevice, where motors, generators, and transformers will be made. The firm hopes to compete with England, France, and Germany in the production of electrical equipment and turbines.—*Commerce Reports.*

New Belgian Companies.—A new company has lately been formed in Liége, with a capital of 1,500,000 fr. and the title La Compagnie d'Electricité des Ardennes, to establish electric lighting and power stations in the Ardennes.

R. A. Lister et Cie. have been organised, with a capital of 2,000,000 fr., for the construction of agricultural, electrical, and industrial machinery.

New Italian Company.—There has been formed at Rome a company, styled the Società Metropolitana di Genova, for the construction and working of an electric underground railway from Sanpierdarena to Genoa, with future extensions, the plans of which have secured the approval of the Ministry of Public Works. The initial capital is fixed at 5,000,000 lire, the bulk of which has been taken up by the syndicate of Spanish capitalists which was concerned in the initiation of the Barcelona underground railways.

New Size C.M.A. Cable.—In response to a desire expressed by users of electric cable to be supplied with a cable intermediate in area between the standard sizes of .75 sq. in. and 1 sq. in., the members of the Cable Makers' Association is now manufacturing and listing, as a C.M.A. standard size, a cable of .85 sq. in. area (127/.093).

Christmas Decoration.—Electricity is entering largely into the decorative schemes with which the London restaurants are marking the Christmas season. At the Connaught Rooms, "Osram" Christmas-tree outfits are being employed. These consist of small electric lamps of many colours wired in series on flexible decoration strip, complete with adaptors for enabling the outfits to be attached to ordinary lamp-holders.

E.D.A. Salesmanship Conferences.—Owing to the presence of many leading electrical men at the "Ideal Home" Exhibition in Newcastle, the local salesmanship conference which was to have been held on November 22nd has been postponed to December 13th. The proximity of Christmas has led to the cancelling of the conference arranged for December 22nd.

Annual Dinner.—Speaking at the annual dinner of the Swansea Electricity Works Department, the chairman of the Electricity Committee emphasised the importance of power as compared with mere considerations of lighting, and said that Swansea in that respect was in a unique position. Roughly, 75 per cent. of the energy produced at the Swansea station was utilised for power, and the remaining 25 per cent. for lighting purposes. He also said he remembered that in the old days they thought they had reached the pinnacle when they had an output of a million kWh. Now the output was fourteen million kWh, and next year it would probably reach 20 millions.

The Germans in South America.—Lecturing at the City of London College on Monday upon the potentialities of South America, Señor Oscar Victor Salomon, Consul-General for Peru in London, emphasised the opportunity that existed for extending British trade with Latin America. Germany, he said, was energetically pushing her trade intereste and acquiring fresh markets in that Continent. He added that the immense importance of increasing Britain's trade with South America could not be too strongly emphasised in the face of the magnitude of the unemployed problem in this country. *Daily Telegraph.*

Cordoba Copper Developments.—In a circular to the shareholders, the directors of the Cordoba Copper Co. state that work will be expedited in future, due to the installation of an air-compressor and other steam-driven machinery, which has been quite recently put into commission. Continued satisfactory results of the development work warrant the board arranging for the designing of electric power and concentrating plant, smelter, and refinery; specifications for these have been practically completed.—*Financial Times.*

Radio Apparatus Retailers and Manufacturers.—In a communication which we have received from Mr. A. H. Clifford, the honorary secretary of the Wireless Retailers' Association, it is pointed out that the present trade discount of 20 per cent. allowed by manufacturers of radio apparatus to retailers is inadequate. This contention is based upon the difficulty experienced by retailers in meeting their usual business expenses, and, at the same time, acting gratuitously as consultants and even as erectors to their customers. They are compelled to assume this *rôle* if they are to sell apparatus. It is considered that the manufacturing costs under the mass production systems employed are such as to enable manufacturers to allow larger discounts and still make adequate profits. Another grievance mentioned is the fact that manufacturers establish radio "depôts" indiscriminately at the establishments of tradespeople who can hardly be considered experts in the subject. With regard to the prohibition of the use of foreign apparatus, the Association, while recognising the need for some measure to increase employment in this country, considers that the imposition of a tariff would have been equally effective and would not have affected the retailer so adversely. In conclusion, the Association invokes the aid of the Postmaster-General in the matter, as it is thought that only by his intervention will better terms be secured in the matter of discounts.

Transvaal Power Supply.—The project for the erection of a large power station on the Witbank coalfield is still held up by legal and other difficulties. There is now a proposal to include the Johannesburg municipal area within the scope of the scheme, and if this is approved by the Electricity Control Board, which is holding an inquiry with respect to the Victoria Falls Power Company's schemes, it will mean the abandonment of the municipality's scheme which was to have cost £500,000. The overlapping of the Victoria Falls Power Company's huge schemes and those of the municipalities within its area has long been a subject of contention, and the Electricity Control Board appears to favour a policy of unification.—*Reuter's Trade Service* (Johannesburg).

Members of the Johannesburg Town Council complain that the arrangement to include the municipal area in the scope of the scheme was made between the company and the Commission without consulting the Council. They state, according to the *Cape Argus*, that the "permissiveness" of the proposals is not sufficiently assured.

South African Electrical Business.—Reporting upon trade conditions in October, the *South African Mining and Engineering Journal* stated that dealers in electrical goods were complaining of a lack of business, but were hopeful of better things with the advent of the increased building activity which was apparently imminent.

British Industrial Development and Unemployment.—Messrs. Leopold Farmer & Sons, factory specialists and surveyors, London, write as follows:—

"It might be interesting to your readers to know that in the year 1909 an alteration was made to the then existing Patent and Designs Act, which was to the effect that articles patented in this country by foreign firms should be manufactured here. We were very intimately connected with this matter, in being instrumental in fixing up foreign firms with factories, &c., to work here, and our records show the following approximate figures:—

1. Value of land and premises acquired	£367,000
2. Amount expended in buildings, housing workpeople, &c.	£532,500
3. Amount expended on plant, machinery and equipment	£752,000
4. Value of annual assessment on which rates were paid	£90,000
5. Amount paid as rates per annum	£30,000
6. Number of workpeople (male and female) employed, about	15,350
7. Amount paid in wages per week, about	£17,600
8. Number of foreign firms working	50
9. Number of English firms manufacturing for foreign firms on royalty basis	35

"It must be borne in mind that the above analysis does not in any way represent the total benefit that accrued to England under this Act. The figures supplied are those which came under our special notice through dealing with the firms who established themselves here. At that period there were many Continental patent holders who did not build new factories, but nevertheless made arrangements for British manufacturers to have their patents produced here. We venture to think that what the Patents Act did to increase employment in the manufacture of patented articles, Tariff Reform will do for employment in our national industries. An interesting sidelight on the present suggestions on Tariff Reform is before us as we write, by the applications received from Continental firms for establishing factories in this country, if an alteration is made in our fiscal policy. We are quite confident there would be a great many works opened up here, which would mean a very considerable amount of labour being employed, money expended on land and buildings, plant and machinery with its attendant advantages to the community in general."

In the course of his speech in the House of Commons in reply to the Vote of Censure on the Government, Sir P. Lloyd Greame, President of the Board of Trade, made the following remarks (see *Times*, November 16th, 1923):—"Questions had been asked as to the effect which duties would have upon certain trades. As a result of the duty placed on motor-cars, the Ford Co. had set up motor manufacturing works and were employing labour here. The chairman of the General Electric Co. told him that since the Prime Minister announced his policy he (the chairman) had received letters from foreign firms asking whether that policy was likely to go through, and saying that if so they proposed to establish factories in England."

Melbourne Electrical Exhibition.—H.M. Trade Commissioner in Melbourne reports that the Electrical Federation (Victoria) will hold an electrical exhibition in Melbourne in September next year. It is hoped to show every known type of electrical apparatus, from toys to machinery. In many cases complete working models of electric transport, lighting and other industrial systems will be shown. Wireless in all its ramifications will be a feature, both in telegraphy and telephony, and also for distance controls. It is intended to make this exhibition the biggest and most comprehensive ever held in the Southern Hemisphere.—*Board of Trade Journal.*

New Cable Packing.—The British Insulated & Helsby Cables, Ltd., has decided to discontinue the method of wrapping coils of braided cable up to the 7/.029 size with hessian tape. Instead a circular cardboard box is to be used for packing them. This will be just as convenient for wiremen to carry, as there is a circular hole in the centre of the box. The coil will be available for use in a shorter time, as, instead of unwrapping yards of hessian, the coil will be lifted from the box after the cutting of three tapes.

Local Exhibitions.—Leeds.—On November 13th a Health and Municipal Services Exhibition was opened by the City Council at the Artillery Drill Hall. It will remain open until December 1st.

The exhibition was the leading feature of the Leeds "Health Week" campaign, and it aims at giving the necessary publicity to the health and other municipal departments, including the electricity department. The exhibition has been assembled under the joint direction of Dr. J. J. Jervis, medical officer of health, Mr. C. N. Hefford, engineer and manager of the electricity department, and Mr. C. S. Shapley, gas engineer and manager. With the assistance of a few private firms of apparatus manufacturers, the whole of the extensive exhibition space in the hall has been occupied. The electricity exhibit emphasises the uses of current in lighting, power and heating. The opening ceremony was performed by the newly-elected Lord Mayor (Sir Edwin Airey), and amongst those present were the Lord Mayor of Bradford and the Mayors of Huddersfield, Halifax, Harrogate, Morley, Pudsey and Batley. The ceremony was followed by a luncheon.

Paisley.—During the present week an exhibition arranged by the Corporation Electricity Department has been in progress. The display of cooking, heating, and labour-saving appliances was opened by Provost Glover, who referred to the success of the electricity undertaking, and paid a tribute to the engineer, Mr. W. Blair Smith.

The Boilermakers' Lockout.—The conference between the Shipbuilding Employers' Federation and the Boilermakers' Union, which was held in Edinburgh last week, practically ended the dispute, which has been in progress for seven months. The terms of the agreement are subject to ratification by the members of the Society, but it is not anticipated that the result of the ballot will be otherwise than favourable. Work, however, will not be resumed until the result is announced.

The agreement is on the following lines:—"It is agreed that federated establishments will, so far as work is available, be open to members of the Boilermakers' Society on the following basis—namely, the Federation will consider with the Boilermakers' Society in committee how far, on five points named by the Society, the operation of the terms of the national overtime and night-shift agreement reveals anomalies which need correction, or special circumstances peculiar to members of the Society or any class of them which need adjustment. Failing mutual agreement in committee the points of difference to be referred to the Industrial Court for determination on terms of reference to be mutually agreed; provided that in the meantime the Society agrees that its members will operate the provisions of the agreement until, and accept it when such corrections or adjustments have been decided upon either by mutual agreement or by arbitration. Such corrections or adjustments, when decided upon, shall apply retrospectively from the date of resumption of work. The delegate conference of the Boilermakers' Society agrees to recommend to the society acceptance of the foregoing proposal of settlement."

Spanish Foreign Trade.—A report received by the Department of Overseas Trade from Capt. U. de B. Charles, C.B.E., Commercial Secretary at Madrid, shows that machinery imports for the first six months of the current year were 53 million pesetas in excess of those of the equivalent period of 1922. Among the principal items included under this heading are Diesel engines, textile and agricultural machinery, and electrical machinery. The total value of machinery imported was 179.6 million pesetas. Machinery exports were valued at 3.9 million pesetas, as compared with 3.6 millions in the first half of 1922.

Catalogues Required.—Messrs. Alex. Cree & Co., Ltd., 162, Buchanan Street, Glasgow, wish to receive catalogues and price lists of electrical fittings and accessories, kinema supplies, novelties, and radio apparatus.

German Industry During October.—The Commercial Secretary at Berlin (Mr. J. W. F. Thelwall) has forwarded to the Department of Overseas Trade a review based on the reports of the Prussian Chambers of Commerce on trade and industry during October. The decline in economic life which began to be accentuated in August was greatly intensified in October. The reason lay in the internal and, particularly, in the foreign political situation which was not relieved, as had been hoped, by the abandonment of passive resistance in the Ruhr. Restriction of work, dismissals of workmen, low wages and high prices which exceeded the world's market level more and more were characteristic of the low condition of economic life.

The abandonment of passive resistance did not change the position in the Ruhr. As before, the pits and foundries were idle. Their position could scarcely be imagined more intolerable. Coal and coke supplies continued to be dispatched by the French.

The electro-technical industry reported that prices for semi-manufactures were high and delivery periods short. The market was small and stagnant, and individual works reported falling prices. Short-time work was introduced on a fairly large scale.

Electricians' Wages.—District Council No. 2 for the Electricity Supply Industry (Yorkshire, &c.) has informed the general manager of the Sheffield Corporation Electricity Supply Department that the wages of the men engaged by the department on competitive contracting work are not governed by the Council's schedule, but should be at the Contracting Council rate.

The Council has also considered a communication from Hull stating that the whole of the staff of the electricity works had voted in favour of ceasing work in view of the Council's decision not to agree to an increase in the wages of all grades of 1d. per hour. Two members of the trade union side of the Council were appointed to take up the matter and report to the next meeting on December 12th.

Social Event.—The second annual whist drive and social evening of the staff and friends of Duram, Ltd., and its associated companies was held on November 17th at Jones's Restaurant, W.1. Mr. H. E. B. Wilkins officiated as M.C. Prizes were provided by the company.

Press Publicity and Unemployment.—Addressing the Chamber of Trade at Hastings on Tuesday, Mr. Samson Clark said that the importance of publicity as a preventive of unemployment was not sufficiently appreciated. It was an unquestionable fact that manufacturing and distributing firms who consistently advertised in the newspaper Press were much better able to withstand periods of trade depression than non-advertising firms. Through such publicity, added Mr. Samson Clark, their wares were known over a much wider area, and they enjoyed a greatly increased field of operations, which tended to stabilise their trade. Newspapers, both daily and weekly, afforded the most economical method yet devised of extending trade and so minimising unemployment.—*Financial Times.*

Railway Steel Contracts.—The Barrow Hematite Steel Co. has booked a new order which will keep its works going for several months. The *Financial Times* understands that this order is in connection with home railway development.

E.D.A. Activities.—The more recent publications of the British Electrical Development Association include an anticipatory view of the British Empire Exhibition in which the position of the great Machinery Palace is marked. Mr. Hugo Hirst's address on the electrical industry recently broadcast from "2 LO" is reprinted in pamphlet form, and E.D.A. 409, "Dr. Brighton takes a hand in the Housing Problem," describes a number of electrically-equipped houses recently erected in one of the residential districts of Brighton.

British Trade Mark Applications.—The following are among the recent applications for British trade marks. Objections may be entered against any of the proposed marks within one month from the dates mentioned. In the case of foreign applications, the names and addresses of the British representatives are also given:—

Remy. No. 430,280. Class 6. Electric self-starters, electric ignition timers and distributors for internal-combustion engines, magnetos and dynamos.—Remy Electric Co., 2,407, Columbus Avenue, Anderson, Ind., U.S.A. (White, Langner, Stevens & Parry, Jessel Chambers, 88-90, Chancery Lane, London, W.C.). November 14th, 1923.

Tudor. No. 430,292. Class 8. Secondary electric storage batteries.—The Tudor Accumulator Co., Ltd., 2, Norfolk Street, Strand, London, W.C. November 14th, 1923.

Magnora. No. 440,548. Class 8. Loud speakers for wireless telephony apparatus.—William F. Pearson, trading as the Conduit Wireless Co., 47, Conduit Street, London, W. November 14th, 1923.

Autocrat. No. 440,898. Class 8. Wireless and other telegraphic and telephonic apparatus.—W. Ivy Rogers, 2, Park Hill, Moseley; Joseph T. Foster, 43, Willow Crescent, Cannon Hill; and Ellen Howell, 2, Readings Road, Moseley, all of Birmingham. November 14th, 1923.

Amrex. No. 436,657. Class 8. Thermionic valves.—The Electron Co., Ltd., Electron Works, 84, Acton Lane, Harlesden, London, N.W. November 14th, 1923.

Robosite. No. 439,203. Class 8. Apparatus for wireless telegraphy and telephony.—Ross Bros. (Glasgow), Ltd., 69a, West Nile Street, Glasgow. November 14th, 1923.

Allfons. No. 439,830. Class 13. Electrical connections, terminals and binding posts.—Robert O. McGown, 7, Denman Street, London Bridge, London, S.E. November 14th, 1923.

Rex (lettering and design). No. 437,128. Class 18. Electrical hot plates for cooking.—Aktieselskabet Elektrisk Bureau, 17, Middelthunsgate, Christiania, Norway. (McKenna & Co., 31-34, Basinghall Street, London, E.C.) November 14th, 1923.

Voltex. No. 440,817. Class 50. Insulating materials for electrical purposes.—M. Barr & Co., Ltd., 83, Hutcheson Street, Glasgow. November 14th, 1923.

Valaisite. No. 409,221. Class 50.—Electrical goods for insulating purposes made from plastic composition. Horace S. Benjamin, Arthur J. Dillon, Arthur C. Dillon, and Benjamin Lanzner, trading in co-partnership, 99, Palmerston Road, South Acton, London, W. November 7th, 1923.

New French Companies.—The Société anonyme ayant pour objet toutes opérations se rattachant à l'Electricité has been formed at Paris (5, Square de Chatillon), with a capital of 200,000 fr., in 500 fr. shares, of which 270, with 100 founders' shares are allotted as consideration for assets.

The Appareillages Electriques Guillimain Mitton, Matry et Meunier has been formed to take over the electrical apparatus factory at 118, Rue de Bagnolet, Paris. Capital, 150,000 fr.

There has been embodied at Paris (6, Rue de Maubeuge) the Société anonyme Energie Electrique Oléronnaise, being the transformation of the previously existing Société en nom collectif Chaignaud et Parenteaud. Its capital is 1,000,000 fr., raisable to 1,200,000, of which 3,000 250-fr. shares are apportioned to the latter company. The capital also includes 1,200 founders' shares.

L'Agence Française de la Société Continentale de l'Accumulateur Edison is the name of a new concern which has lately been formed in Paris (54, Rue de Lancry), with a capital of 550,000 fr.

Russian Industrial Notes.—*Gas for Lamps.*—The General Electrical Commission, which is now devoting special attention to the development of production in the manufacturing industry, is making arrangements for the production of inert gas for gasfilled lamps.

Turbo-generator Purchases.—The Ural Platinum Trust has put forward an application to the Supreme Council of National Economy for permission to purchase turbo-generators from abroad. If the machines were ordered from Russian works, the Trust states that a year would be required to effect delivery, whereas the plant is needed in April if the programme of the Trust is to be carried out.

A Large Hydro-electric Scheme.—The question of making a beginning with the utilisation of the falls of the Dnieper will have to come forward in the near future, and the magnitude of the undertaking, which is expected to yield from 400,000 to 450,000 kW, is such as to suggest that the participation of foreign capital will be necessary for the realisation of the project.

Nationalised Telephone Factories.—It is reported that the L. M. Ericsson Telephone Company has for some time past been in negotiation with the Soviet authorities with a view to the resumption of possession in some form or other of the company's properties in Russia which have been nationalised. It is assumed that the negotiations have proceeded in the direction of the suggested return of the properties to the Swedish company in the form of a concession, similarly to the manner in which the Swedish Ball Bearings Company is again getting possession of its works in Russia. At the same time, there is no information available to the effect that the ball bearings company has actually taken over the undertaking.

New Zealand Tariffs.—The Customs authorities of New Zealand have recently given a decision to the effect that "metal poles, plain (not being pipes, tubes or tubing, or towers or similar articles), specially suited for electrical transmission lines" are to be subject to a duty of 10 per cent. under the general tariff, and British manufactures admitted free.

Swiss Enterprise Abroad.—It is stated that as the Bank for Electrical Undertakings of Zurich has now been completely reorganised, the directors intend to resume the activity of this investment company in other countries. It is proposed to devote attention to Austria in the first place, and financial participation in undertakings will chiefly be dependent upon consideration being given to Swiss industry in the allocation of orders for new plant.

French Imports and Exports.—According to the French Customs returns the imports of electrical machinery and plant amounted to 5,465 tons in the first nine months of the current year, this quantity comparing with 6,486 tons in the corresponding period of last year. The values were 96,069,000 fr. and 84,674,000 fr. in the two periods respectively. As to the exports, it is shown that these rose from 8,173 tons of the value of 134,415,000 fr. in the first nine months of 1922 to 9,273 tons and 170,759,000 fr. in the same period of the present year.

LIGHTING AND POWER NOTES.

Australia.—Tasmania.—*Launceston.*—The accounts of the municipal electricity undertaking (engineer: Mr. R. J. Strike) for the year ended June 30th, 1922, show a total revenue of £43,859, as compared with £51,647 in 1920-21. Working expenses totalled £27,393, as against £34,266, leaving a gross profit of £16,466 (£17,381). Of this amount £11,823 was absorbed by loan interest and £2,117 was contributed to sinking fund, leaving a net profit of £2,455, as compared with £6,044 in the previous year. The capital expenditure during the year amounted to £17,694. A total of 4,200,834 kWh of electrical energy was sold, and connections were increased by 200 to 7,477 kW.

Abingdon.—Special Order.—The Abingdon Electric Supply Co., Ltd., has applied to the Electricity Commissioners for a Special Order authorising it to extend its area so as to include certain parishes in the Rural Districts of Abingdon and Culham.

Bessecarr (Yorks.).—Electricity Scheme.—A number of residents have formed a non-statutory company with the object of supplying the residential quarter of the parish with electricity, which will be drawn from colliery sources. No dividend will be paid, and only members or shareholders of the company will be entitled to a supply.

Continental.—Austria.—Negotiations have been proceeding for some time between an Italian and an Austrian group for the formation of a company for the utilisation of water power in Styria. The participation of the Italian group is now said to be certain. This group will take most of the shares, and the remainder will be in the hands of Viennese banks. The Italian Government has approved this operation, which will mean large orders of material for the Italian industry.—*Reuter's Trade Service* (Vienna).

Italy.—A sum of 160,000,000 lire has been placed by the Italian Government at the disposal of the Società per le Forze Idrauliche del Sila, the Società Meridionale di Elettricità, and the Società Generale Elettrica della Sicilia for the carrying out of the following programme of works:—(1) The erection of the Sila hydro-electric station of 100,000-h.p. capacity; (2) a h.p. transmission line from the Sila station; (3) a distribution line in the Province of Puglia for current from the Sila station; (4) completion of the Matese hydro-electric station in the Province of Catania, with transmission lines in the Provinces of Benevento, Caserta, Napoli, and Salerno, and with a future line linked with Sicilian water-power generating stations; (5) completion of the hydro-electric station at Alto Belice, near Palermo; (6) distribution lines in the Provinces of Palermo and Trapani; (7) setting up of a hydro-electric station on the Simeto in connection with the irrigation scheme in the plain of Catania; (8) a transmission line from Messina to Palermo; and (9) a distribution line in the sulphur mineral field of Sicily and in other districts of Isola not yet served with electricity. The works projected two years ago are now being undertaken to relieve the present unemployment in Italy.

France.—The Compagnie Générale du Gaz pour France et l'Etranger has secured a concession for the distribution of electricity in a number of districts in the departments of the Indre-et-Loire and Vienne; and a commencement will be made as soon as the plans are approved. The works are expected to take two years to complete.

A concession to supply electricity to 33 communes in the department of Saône-et-Loire has been applied for by the Société des Entreprises Electriques du Centre.

Cranbrook.—Electricity Supply.—The Rural District Council has decided to support the application of the Cranbrook Electricity Co. for powers to supply electricity in the rural area. The Tenterden Council has also approved of the company's application to supply electricity in the town.

Dover.—Loans Sanctioned.—The Town Council has received sanction to a loan of £21,336 for new plant at the electricity works, and for £3,502 to meet the cost of the frequency changer.

Douglas (Isle of Man).—Electricity Charges.—The Town Council has decided to offer consumers an alternative flat rate of 9d. per kWh for lighting and 4d. per kWh for cooking, heating, and power.

Elland.—Street Lighting.—The Electricity Committee has approved a scheme for lighting the whole of the streets by electricity, which will involve the laying of 18½ miles of cable at an estimated cost of £7,500. The estimated annual cost of the lighting is £1,490, as against the former £1,606.

Irish Free State.—Naas.—The No. 1 Rural District Council has given notice of its intended application for a Provisional Order to supply electricity in bulk and also for the public lighting of all towns and villages in the Council's area, and to establish a generating station at Bishopsland, Co. Kildare.

Templemore.—The Urban District Council is considering a scheme for lighting the town by electricity. At present the streets are lighted by petrol vapour lamps.

Lanark.—Proposed Electricity Scheme.—It was intimated at a recent meeting of the Town Council that a member of an Edinburgh legal firm, along with Mr. Hogarth, electrical engineer, had called upon the Town Clerk with reference to the proposed formation of a company to erect a power station at the falls of the River Clyde, and it was stated they were considering the question of making application to Parliament next session for this purpose. The matter was remitted to the Law Committee.

London.—Woolwich.—The Borough Council has applied for a grant in respect of changing over from d.c. to a.c. distribution estimated to cost £27,162. The Electricity Commissioners are prepared to certify the proposal for the purposes of a grant from the Unemployment Grants Committee, and the London County Council has concurred.

Stoke Newington.—The Electricity Committee has recommended the following reductions in the charges for electricity as from November 25th:—(1) For private lighting (scale B), from 5½d. to 4½d. per kWh. (2) For power (scale C), from 4½d. and 1½d. on the maximum demand system to 4d. and 1d. per kWh; and Scale E, from 2½d. to 2d. for the first 5,000 kWh, and from 1½d. to 1d. for all energy above 10,000 kWh. The charge for the second 5,000 kWh is to remain at 1½d. per kWh as at present. Meter rents: Up to 10 A, from 2s. 6d. to 2s. per quarter; 10 to 50 A, from 3s. 3d. to 2s. 6d.; and above 50 A, from 4s. to 3s.

Fulham.—The Electricity Committee has had under consideration the following two schemes, submitted by the borough electrical engineer, for extensions to the electricity works:—(a) To meet the requirements of the borough for the next five years: Two 5,000-kW turbo-alternators, complete with accessories, at a cost of £110,000. (b) To meet the requirements of the borough and neighbouring authorities: Two 10,000-kW turbo-alternators, complete with accessories, at an estimated cost of £180,000. It was stated that scheme (b) would entail a heavy additional cost upon the undertaking. The Committee has therefore recommended to the Council that two 6,000-kW sets be installed at an estimated cost of £120,000, and that application be made to the Electricity Commissioners for sanction to borrow that amount. The scheme will take two years to complete. Meanwhile, arrangements have been made for the extra supply of electricity required over and above the present capacity of the station to be obtained either from the Battersea or Hammersmith power stations.

Long Eaton.—Year's Working.—The accounts of the municipal electricity undertaking (engineer: Mr. F. Newey) for the year ended March 31st last record a total revenue of £18,087, as compared with £18,183 in 1921-22. The working expenditure was £11,292, as against £13,931, leaving a gross profit of £6,745 (£4,252). Capital charges remained at about the same level, and the net result was a profit of £2,471. In the previous year a loss of £87 was incurred. The generating statistics show an increase in the sale of energy from 1,008,702 kWh to 1,184,885 kWh; the load factor improved from 18.49 to 21.95 per cent.; and the plant capacity remained at 1,450 kW.

Menai Bridge.—Electricity Supply.—In addition to its purchase of the electricity undertaking of the Menai Bridge Electricity Supply Co., the Council intends to extend the supply area to Cadnant. Sanction has been received from the Electricity Commissioners to the borrowing of £3,171. Consumers are to be charged 7d. per kWh.

Loan.—The Urban District Council has applied to the Electricity Commissioners for sanction to a loan of £3,101 for completion of arrangements for a supply of electricity from Bangor.

Milnrow.—Extension of Supply.—On the recommendation of the Electricity Committee, the Urban District Council has applied to the Electricity Commissioners for sanction to the borrowing of a further amount for the extension of the electricity supply to Newhey.

North Metropolitan E. P. S. Co.—Projected Bill.—The North Metropolitan Electric Power Supply Co. has given notice that it intends to apply for leave to bring in a Bill in the next session of Parliament to secure additional powers. It is proposed to extend the company's area of supply so as to include the Urban Districts of Baldock, Bishop Stortford, Hitchin, Royston, Sawbridgeworth, and Stevenage, and the Rural Districts of Ashwell, Buntingford, Hadham, and Hitchin, in the county of Hertford; and the Urban Districts of Buckhurst Hill, Epping, Loughton, Wanstead, and Woodford, and the Rural District of Epping, in the county of Essex. The powers of the company with respect to the Urban Districts of Tottenham, Edmonton, Enfield, Wood Green, and Southgate are to be enlarged and modified. Prices and methods of charging are to be arranged, and power is to be secured to acquire land and erect generating and transforming stations. The financial clauses are to include powers to raise additional capital, &c.

Northern Ireland.—Bann Power Scheme.—The River Bann power scheme has been revived, and a Bill is to be introduced in the Northern Ireland Parliament. It is proposed to form a company to utilise the River Bann for generating electricity, and to distribute the energy to parts of Counties Antrim and Londonderry.

Oxford.—Electricity Order.—The Oxford Electric Co., Ltd., has applied to the Electricity Commissioners for an Order to extend its area of supply so as to include the parishes of Sandford-on-Thames, Cowley, Elsfield, Forest Hill, Shotover, Headington, Horsepath, Iffley, Littlemore, Marston, Cutteslowe, Water Heaton, Wolvercot, and Pixey Mead.

Shrewsbury.—Loan Sanctioned.—The Town Council has received the sanction of the Electricity Commissioners to a loan of £9,250 for mains, services, &c.

Southend-on-Sea.—Electricity in Bulk.—The Essex Power Co. has informed the Town Council that it proposes to construct a power station at Mersea Island, and inquired whether the Council is prepared to enter into negotiations for a supply of electricity in bulk. Consideration of the matter has been adjourned. The Rayleigh Parish Council has written asking whether the Corporation is prepared to supply electricity to the parish for public and private purposes.

Southwick.—Electricity Supply.—The Urban Council has agreed to terms for a supply of electricity from the Brighton Town Council. The charges are to be 7d. per kWh for lighting and 2d. per kWh for power.

Tring.—Proposed Electricity Supply.—The Urban District Council, which has been in communication with Aylesbury Town Council regarding a supply of electricity, proposes to obtain expert advice upon the matter. The estimated cost of the proposed supply is £8,500.

Tunbridge Wells.—Loan Sanctioned.—The Town Council has received the sanction of the Electricity Commissioners to a loan of £53,200 for extensions to the electricity works.

Watford.—Loan.—The Town Council has applied to the Electricity Commissioners for sanction to a loan of £20,000 for converting the electricity supply from single-phase to three-phase.

Wirral.—Opposition to Scheme.—The Neston and Parkgate Urban Council has decided to lodge a formal objection to the application of the Gayton Park Electricity Co., Ltd., for an Order to supply electricity in Wirral. The Council is to confer with the Wirral Rural Council and the Bebington and Bromborough Urban Council with a view to the provision of a joint electricity scheme.

TRAMWAY AND RAILWAY NOTES.

Australia.—Tasmania.—*Launceston.*—The accounts of the city tramway undertaking for the year ended June 30th, 1922, show a total revenue of £45,374, as compared with £42,591 in 1920-21. Working expenses amounted to £38,577 (£36,510), leaving a gross profit of £6,797, as against £6,081. Interest on loans amounted to £7,483, and £1,427 was contributed to sinking fund, leaving a net deficit of £2,113, as compared with a deficit of £3,642 in the previous year. The total number of passengers carried was 4,281,697, a decrease of 143,633; the number of car-miles run increased by 715 to 462,537.

Chile.—Santiago.—The municipality and the British Tramways and Electric Light Co. have reached an agreement according to which tramway fares will be doubled in consideration of the expenditure of £1,000,000 for the improvement of the service.—*Reuter* (Santiago).

Halifax.—Tramway Track Flooded.—As a result of the recent heavy rainfall, the Corporation tramway service between Mytholmroyd and Hebden Bridge had to be suspended on the worst day of the floods, when the River Calder overflowed its banks.

London.—Edgware Line.—The first section of the Edgware line, between Golder's Green and Hendon, was formally inaugurated on November 19th by Sir Philip Lloyd-Greame, President of the Board of Trade. This section has taken 17 months to construct, is 1½ miles in length, and has cost over £500,000.

Mansfield.—Tramway Extensions.—The Mansfield Tramways Co., Ltd., proposes to seek Parliamentary powers to enable it to extend its service to Warsop, Clipstone, Edwinstowe, and Ollerton.

Plymouth.—Tramway Improvements.—At a recent meeting of the Corporation, the Tramways Committee announced that it had been decided to carry out improvements to the tracks in St. Levan Road and from South Keyham gates to North Keyham gates. It was also intended to lay new track on Hartley Hill.

Wrexham.—Tramway Extensions.—It is proposed to extend the tramway track from Duke Street, Rhos, along Hill Street and Canal Street to the end of Broad Street, Rhos, at a cost of about £10,000.

TELEGRAPH & TELEPHONE NOTES.

Cook Islands.—Radio Installations.—The erection of two radio stations at Aitutaki and Mangaia, two of the Cook Islands in the Eastern Pacific, which has been authorised by the Cabinet, will be of great value to shipping and merchants. Three young Rarotongans have been selected for training in radio telegraphy in New Zealand, and are expected to qualify in time for the next fruit season. The installation in these islands will enormously assist towards the reduction of running costs to shipping, and will also ensure the expeditious handling of large fruit cargoes.—*Reuter* (Wellington, N.Z.).

India.—New Radio Station.—A Bombay firm has registered a company named the Indian Radio-Telegraph Co., Ltd., with a capital of three crores of rupees, for the purpose of erecting a high power radio station in India.—*Indian Engineering.*

Irish Free State.—New Cable Landed.—The cable ship *Colonia*, belonging to the Telegraph Construction and Maintenance Co., arrived last week at Waterville, Co. Kerry. The vessel had on board two cables for the Commercial Cable Co.—one to be laid to Le Havre, France, and the other to the Azores. The work of landing both cables was got through very expeditiously, although weather conditions were not very favourable at the time. Both cables were landed on the beach, and connected subsequently with the necessary apparatus in the new testing hut at Waterville. The shore end of the cables has not yet arrived.

Manila.—Typhoon Damage.—A typhoon from the Pacific has swept over Luzon and the Visayas Islands. Rail and telegraph communication has been entirely suspended.—*Reuter* (Manila).

South Africa.—High-power Radio Station.—It will be remembered that the Wireless Telegraph Co. of South Africa, Ltd., was recently organised to provide international telegraphic service for the Dominion. The principal station is to be located at Klipheuvel, Cape Province—about 30 miles by rail from Cape Town. The site comprises about 2,110 acres, and is about 10 miles distant from any mountains. It is estimated that the station will be in operation in about 18 months. The power of the new station will be 750 kW, and it is probable that it will operate on a wave length of about 16,000 metres. The aerials will be supported by 16 towers 800 ft. in height, arranged in the form of a circle, having a diameter of 1½ miles. Beneath this circle an earth screen will be supported on 250 towers 40 ft. in height.—*Commerce Reports.*

Syria.—New Telephone System.—A copy of a draft agreement for the construction and exploitation of a telephone system in Syria and the Lebanon is available for inspection at the Department of Overseas Trade (Room 52).

RADIO NOTES.

Australia.—Radio Weather Reports.—The Navy Department of the New Zealand Government, acting in conjunction with the Australian Government, has inaugurated a service for broadcasting weather reports sufficiently comprehensive to be available to any ship in the waters surrounding New Zealand and Australia or the Pacific islands. The co-operation of ship masters is sought in reporting weather conditions.—*Commerce Reports.*

Radio-Broadcasting. — Trans-atlantic Tests. — Attempts will be made between November 26th and December 2nd to establish radio-telephonic conversation between England and America by means of simultaneous transmission by the British Broadcasting Co. from London, Birmingham, Cardiff, Glasgow, Bournemouth, Newcastle, Manchester, and Aberdeen on wavelengths varying from 353 to 495 metres. The tests will start at 3 a.m., and the English stations will transmit for 45 minutes. After that, from 3.45 a.m. until 5.15 a.m. each of the eight British stations will transmit separately, one after the other, for 10 minutes each. Results from America will be received by cable. On the following day America will transmit to us for test purposes. On December 2nd there will be an attempt at two-way communication, England transmitting at five-minute intervals from 3 a.m. and the U.S. replying at similar intervals, starting at 3.5 a.m.

Sheffield Relay Station.—The first relay station in the country, that at Sheffield, was formally declared open by the Lord Mayor, Ald. Blanchard, last Friday evening in the presence of a large company. The establishment of that station has increased the demand for apparatus in Sheffield and district, particularly crystal sets, which, with the aid of the relay station, now give good results. One day per week is assigned to Sheffield for broadcasting a programme of its own, the remaining days being devoted to relaying London and Manchester programmes. Capt. P. P. Eckersley, chief engineer of the British Broadcasting Co., announced that the present wavelength of 350 metres is to be reduced to 300 metres. This is due to the fact that valve-set owners have found it difficult to tune out Sheffield when desirous of obtaining more distant stations.

South Africa.—Radio Licences.—Under regulations recently issued, the Postmaster-General is given extensive power with regard to the issuance or cancellation of radio licences. These are of three classes, the broadcast licence is granted for a period of five years and is renewable, on application, during the fourth year. The broadcaster is authorised to rent receiving sets, to charge for broadcasting, to send out advertising matter for not more than 10 per cent. of the total broadcasting time each day, and to make contracts with persons having listening licences. He is obliged, however, to broadcast public information free of charge during certain limited periods at the request of the Postmaster-General. An experimenter's licence covering receiving and transmitting costs is 10s. per annum, but such licences carry with them the obligation of a contract with the broadcaster in whose zone the experimenter is located. For the purposes of this contract, the broadcaster may charge only one-third of the listening rate, but at the present time this rate has not been specified. Receiving licences carry a charge of 5s. per annum. The licences for experimental or amateur stations forbid the imposition of any charge by the persons holding them. Experimenters are restricted to two periods a week for transmission, and the aerial used is limited in length to 60 ft. for a single wire and 70 ft. for double wire, while the height above ground must not exceed 40 ft. Listening licences for other than private residences carry an additional charge.—*Commerce Reports.*

U.S.A.—Radio Bill.—The radio-control Bill which failed to pass the last Congress because of the congestion of the Senate calendar in the closing hours of the session will be introduced again early in the next session, according to Secretary of Commerce Hoover. The Secretary said that his information was to the effect that the general lines of the White Bill of the last session would be followed by the new measure, with modifications which would mean simplification, as the result of experience gained in the intervening months. The

principal features of the measure are to vest control over radio in the Department of Commerce, requiring transmitting stations to obtain licences so that confusion in the air may be eliminated by regulations stipulating the wave lengths to be used and hours of transmitting.—*Electrical World.*

Weather Reports at Sea.—Broadcasting Scheme.—The Air Ministry announces that from January 1st, 1924, a weather bulletin for all coasts of the British Isles, specially designed for ships at sea (but also useful to shipping interests ashore) will be broadcast by the Air Ministry long-range radio station.—*The Times.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared in our advertisement pages.)*

OPEN.

Australia.—Sydney.—February 6th. New South Wales Government Railways and Tramways. Equipment of two sub-stations.*

February 27th. Motor generator sets, batteries for switch operating, motor air compressors.*

February 18th. Municipal Council. Armour-clad switchgear.*

Melbourne.—January 9th. Government Railways. Spring coiling machine, with electric motor; taper rolling machine, with electric motor.*

Belfast.—December 18th. The Board of Guardians invites schemes for the installation and equipment of a centralised heating and lighting plant. (November 16th.)

December 1st. Tramways Committee. Construction of about 3,200 yd. of single track. (See this issue.)

Belgium.—November 29th. Municipal authorities of Schaerbeek, Brussels. 9,000 metres of l.p. armoured cable and 15 tons of insulating material.

December 5th. Belgian Post and Telegraph authorities at La Salle Madeleine, Brussels. 12 kilometres of 21-conductor telephone cable, 58,500 metres of lead-covered conductor cable, 1,000 metres of paper-insulated lead-covered cable, &c.

Cork.—November 28th. Cork Harbour Commissioners. Repairs and replacement works (electrical fittings, hardware, brass work, &c.). Mr. James Long, manager and secretary, Harbour Board Offices, Custom House Street, Cork.

Croydon.—November 28th. Electricity Department. One 30,000-lb. steam-raising unit. (November 16th.)

Dublin.—November 30th. Electricity Department, Electricity and Public Lighting Committee. Maintenance and testing of all meters. City electrical engineer, Fleet Street, Dublin.

November 26th. Electric wiring of 332 houses at Fairbrother's Fields. City Treasurer, Exchange Buildings, Lord Edward Street, Dublin.

Eccles.—November 26th. Electricity Committee. 3,060 yd. of .20-sq. in. e.h.p. 3-core cable and 2,300 yd. of .125-sq. in. l.p. concentric armoured cable. Borough electrical engineer, Electricity Works, Cawdor Street, Patricroft.

Edinburgh.—December 4th. Tramways Department. Tramway cars, trucks, and electrical equipment. Tramways manager, 2, St. James' Square, Edinburgh.

December 10th. Electricity Supply Department. Pavement box frames and covers, house service fuse boxes, underground conduits for electricity supply cables. (See this issue.)

Glasgow.—January 16th. Cleansing Department. Tenders and designs for refuse disposal works at Govan. (November 16th.)

November 28th. Tramways Department. Erection of substation at Abercorn Street, Paisley. Specifications, &c., from general manager.

Greenock.—December 8th. Electricity Department. Three 3,000-kVA transformers, h.p. switchgear, transformers with boosters, and induction regulators. (November 16th.)

Ince-in-Makerfield. — November 30th. Urban District Council. Diesel oil engine driving bore hole and horizontal pumping sets, in duplicate. (November 16th.)

India.—Delhi.—January 21st. Public Works Department. Turbo-alternator set, condensing plant, cranes, boiler-house plant, economiser, steel chimney, pipework, switchboards, converters, sub-station plant, e.h.p. feeder cables and accessories. Specification, &c., from the Chief Controller of Stores (Engineering Section), Indian Stores Department, Delhi.

Bombay.—December 17th. One motor-driven air compressor. Deputy Executive Engineer, Mechanical Branch, Municipal Workshops, Foras Road, Bombay.

London.—India Store Department.—November 29th. Switchboard cable and v.i.r. insulated wire. (November 9th.)

November 30th. Sulphate of copper.

St. Pancras.—December 6th. Electricity Department. One vertical electric motor-driven condensing-water pump, capacity 750,000 gallons per hour. (November 16th.)

Metropolitan Asylums Board.—December 5th. Alterations and extensions to the electric lighting and power installation in the new kitchen at Tooting Bec Mental Hospital. (See this issue.)

New Zealand.—Wellington.—January 30th. Post and Telegraph Department. 30,000 galvanised-iron earth rods.*

Porthcawl (Glam.).—The Urban District Council is prepared to grant facilities for the installation and operation of an electricity supply scheme (public company) within its district. (November 16th.)

Rathmines and Rathgar (Co. Dublin).—November 28th. Electricity Department. 300 tons of Scotch split coal for the electricity works. Specifications obtainable at Electricity Works.

Reigate.—December 1st. Town Council. Electric light wiring, Old Town Hall. Borough surveyor.

Rhyl.—November 27th. Electricity Department. Laying new mains, with control switchgear, certain new lamp columns, lamp heads, fittings, time switches, &c. (November 16th.)

South Africa.—Cape Town.—December 10th. South African Railways and Harbours Blockyard plant, Table Bay Harbour Breakwater extension, 3 electrically-driven concrete mixers, 2 electrically-driven stone elevators, 2 electrically-driven sand elevators, 1 electric lift for cement, &c. Particulars from High Commissioners of the Union of South Africa, Trafalgar Square, W.C.

Graaf-Reinet.—December 20th. Municipal Council. Crude oil engines, generators, and street equipment. Specifications and particulars from the Town Clerk, Town Office, Graaf-Reinet.

Southampton.—December 3rd. Electricity Department. Two e.h.p. switch cubicles with control panels and indicating diagrams, &c. (November 16th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

CLOSED.

Belgium.—Only two concerns submitted tenders last week to the Belgian Post and Telegraph authorities in Brussels for the supply of c.b. telephone switchboards required at the Liége central telephone exchange, the lowest offer being that of the Société Electricité et Mécanique, of Saint Giles, Brussels. Three tenders were received for the supply and erection of telephone cables at Saint Nicolas-Waes, Alost and Roulers, the lowest offer being that of a German concern, the Duisburg Kabelwerk Gesellschaft, of Duisburg.

Douglas (Isle of Man).—With reference to the paragraph published in our last issue, Messrs. Handcock & Dykes, consulting engineers to the Douglas Corporation, inform us that while the recommendation to add two 600-b.h.p. 6-cylinder vertical cold starting oil engines has been accepted, there is no intention at present to replace the existing horizontal engines with two 4-cylinder vertical oil engines of 440 h.p. each.

Dover.—Board of Guardians. Accepted:—

Electric lighting of Dover Union schools—Gordon C. Lent.

Government Contracts.—The following Government contracts were placed during the month of October:—

Admiralty Contract and Purchase Department.

Batteries.—Chloride Electrical Storage Co., Ltd.; D.P. Battery Co., Ltd.
Batteries and cells.—Chloride Electrical Storage Co., Ltd.
Electrically-driven capstan.—Cowans, Sheldon & Co., Ltd.
Cells.—Pritchett & Gold and E.P.S. Co., Ltd.
Electric travelling crane.—A. Jack & Co., Ltd. (Sub-contractors for motors: Metropolitan-Vickers Electrical Co., Ltd.)
Electric locomotive crane.—Sir W. Arrol & Co., Ltd.
Electric fans—Veritys, Ltd.
Mercury-vapour rectifier installation.—Hewittic Electric Co., Ltd.
Motor alternator and spares.—Newton Bros. (Derby), Ltd.
Rotary-converter equipment.—English Electric Co., Ltd.
Conduit tubing.—Perfecta Seamless Steel Tube and Conduit Co. (1920), Ltd.; General Electric Co., Ltd.

War Office.

Generators.—Newton Bros. (Derby), Ltd.
Electric wire.—Enfield Cable Works, Ltd.
Electric lighting installations: (Fenham Barracks, Newcastle-on-Tyne).—Grindley, Ross & Co., Ltd. (Lydd).—G. E. Taylor & Co.; (Hillsborough Barracks).—Yorkshire Electric Wiring and Motor Co., Ltd.

Air Ministry.

Accumulators.—Peto & Radford; Edison Swan Electric Co., Ltd.
Battery booster, &c. (Shrewsbury).—D.P. Battery Co., Ltd.
Wireless masts (Egypt).—C. F. Elwell, Ltd.
Delco ignition spares.—Delco-Remy, Ltd.
Pumps.—British Electric Plant Co., Ltd.

Post Office.

Telephone apparatus.—Automatic Telephone Manufacturing Co., Ltd.; British L. M. Ericsson Manufacturing Co., Ltd.; Siemens Bros. and Co., Ltd.; Sterling Telephone and Electric Co., Ltd.; Western Electric Co., Ltd.
Testing, protective apparatus, &c.—Phœnix Telephone and Electric Works, Ltd.; Siemens Bros. & Co., Ltd.
Telegraph and telephone cable.—Enfield Cable Works, Ltd.; Hackbridge Cable Co., Ltd.; Pirelli-General Cable Works, Ltd.; Union Cable Co., Ltd.
Loading coils.—Western Electric Co., Ltd.
Telephone cords.—British Insulated & Helsby Cables, Ltd.; Siemens Bros. & Co., Ltd.
Ducts.—Rainford Potteries, Ltd.
Electric lighting fittings.—Cable Accessories, Ltd.

Insulators.—Bullers, Ltd.; Doulton & Co., Ltd.; J. Macintyre & Co., Ltd.; Taylor, Tunnicliffe & Co., Ltd.
Stoneware Leclanché jars.—J. Bourne & Son.
Telephone lamps.—Edison Swan Electric Co., Ltd.
Insulating oil.—Reesoils, Ltd.
Telegraph poles.—Armstrong, Addison & Co.; Gabriel, Wade & English, Ltd.
Stay rods.—Bullers, Ltd.
Lead seals.—Lead Seal Manufacturing Co., Ltd.
Spindles.—Bullers, Ltd.
Insulating tape—W. T. Henley's Telegraph Works Co., Ltd.
Manufacture, supply, drawing-in and jointing cables.—Gloucester-Newport-Cardiff: Western Electric Co., Ltd. Tunbridge Wells-Eastbourne-Hastings: Johnson & Phillips, Ltd. Rhyl-Colwyn Bay: Pirelli-General Cable Works, Ltd. Manchester-Atherton-Leigh: W. T. Glover and Co., Ltd. Wirral exchanges (Mersey Junction section): British Insulated & Helsby Cables, Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; Elliotts Metal Co., Ltd.; R. Johnson & Nephew, Ltd.; Shropshire Iron Co., Ltd.
Copper wire.—T. Bolton & Sons, Ltd.; British Insulated & Helsby Cables, Ltd.; Johnson, Clapham & Morris, Ltd.; R. Johnson and Nephew, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co. (incorporated in the London Electric Wire Co. & Smiths, Ltd.); J. Wilkes, Son & Mapplebeck, Ltd.
Galvanised-iron wire.—R. Johnson & Nephew, Ltd.
Telephone exchange equipment.—Headingley (Leeds), Stanningley (Leeds), Chapeltown (Leeds): Automatic Telephone Manufacturing Co., Ltd. (Sub-contractors for batteries: Tudor Accumulator Co., Ltd.; Chloride Electric Storage Co., Ltd.; for charging machine: Crompton & Co., Ltd.). Cardiff: Automatic Telephone Manufacturing Co., Ltd.
Telephone repeater station equipment.—Derby-Fenny Stratford: Western Electric Co., Ltd.

CROWN AGENTS FOR THE COLONIES.

Submarine cable.—Siemens Bros. & Co., Ltd.
Spares for train lighting.—J. Stone & Co., Ltd.
Telegraph line material.—Siemens Bros. & Co., Ltd.
Telephone exchange.—Western Electric Co., Ltd.; British L. M. Ericsson Manufacturing Co., Ltd.
H.d. copper wire.—Shropshire Iron Co., Ltd.

H.M. OFFICE OF WORKS.

Engineering services.—Somerset House, W.C., wiring: S. Reed & Sons.

Glasgow.—Corporation. Recommended:—
Electric lighting and heating and bell installation at houses at Stronachlacher and the Royal Cottage (£2,914).—Allan, Arthur & Ure.

Irish Free State.—Commissioners of Public Works. Accepted:—
Electrical works and supplies required in Dublin and district.—Handley and Robinson, Ltd.

Lichfield.—City Council. Accepted:—
Maintaining the electric fire alarms for a year.—T. Barratt & Co.

Liverpool.—For the installation of electric lighting and power at new premises for Messrs. C. & A. Modes, Ltd., Church Street, Liverpool (Messrs. Huntley & Wood, consulting engineers, London, S.W.1):—

	To specification.	Alternative.
Fyy & Co.	£4,341	
Campbell & Isherwood, Ltd.	3,715	
J. Collier & Co., Ltd.	3,497	£3,464
Economic Electric Co.	3,387	
Dod Bros.	3,305	
H. Jones	3,238	
Boothroyd Repairs, Ltd.	3,179	
Haden & Sons, Ltd.	3,044	2,800
Lindsay & Co.	3,030	
F. H. Sowden	2,890	
Whyte, Thomson & Co.	2,825	
J. Hunter & Co.	2,710	2,710
Brightlight Supply Co.	2,450	
Searle, Berry & Co., Ltd.	2,249	
Strode & Co., Ltd.	2,142	
E. P. I., Ltd.	2,062	1,917
Berkeley Electrical Engineering Co.	1,987	1,987
Tredegars (1923), Ltd.	1,845	
T. Clarke & Co., Ltd.	1,799	§1,625
Power and Lighting Supplies Co., Ltd.	1,733	
Will Smith, Ltd.	1,718	

§The contingency item of £100 was deducted and certain extras inserted, making the contract £1,505.

London.—HACKNEY.—Works and Open Spaces Committee.
Renewal of batteries in the Nos. 1 and 2 3½-ton electric vehicles, at £196 13s. 10d. per battery. (Recommended.)

SHOREDITCH.—Lighting Committee. Accepted:—
¼ mile 19/.052 3-core paper-insulated lead-covered armoured cable.—W. T. Glover & Co., Ltd.
¼ mile 7/.064 3-core paper-insulated lead-covered armoured cable; ¼ mile 7/.036 twin rubber-insulated lead-covered armoured cable.—Hackbridge Cable Co., Ltd.
1 mile 7/.064 single paper-insulated lead-covered cable.—Siemens Bros. and Co., Ltd.

Baths Committee.
One continuous-drying machine (capacity 800 towels per hour), excluding wiring and motor (£410).—W. W. Wardle & Sons. (Recommended.)
The Electricity Department's offer to supply one 5-h.p. motor and carry out the necessary wiring at £9. (Recommended.)

ADMIRALTY.—Accepted:—
Spiralised metal-filament traction-type electric lamps.—Siemens and English Electric Lamp Co., Ltd.

Sweden.—Tenders have been received by the Swedish State Railway Administration for the supply and laying of telegraph cables along the railway between Stockholm and Gothenburg in connection with the electrification of this Western railway. The lowest offer was submitted by the Siemens-Schuckert Co., and amounted to 2,211,573 kronen, of which 1,596,414 kr. was for the cables, which were to be made by the Siemens & Halske Co. The next lowest tender was presented by Max Sieverts Fabriks A.B., in conjunction with the Western Electric Norsk A.S. This offer was for 2,376,065 kr., of which the cables formed 1,959,647 kr., but the former figures were subsequently reduced to 2,280,203 kr., or over 3 per cent. higher for Swedish-made cables than in the case of the lowest foreign offer for the whole of the work. If consideration were given only to the small price difference, the railway authorities state that they would be able to accept the offer made by the Sievert-Western group, but another matter comes into account. The authorities say that they understand that great difficulties arise with weak-current cables when first brought into use along electrified railways, and that the German firm has satisfactorily solved these troubles. Under these circumstances the authorities have provisionally accepted the tender of the Sievert Western group for the execution of the cable installation between Stockholm and Falkopin (343 kilometres), and that of the German firm for the cable work between the latter place and Gothenburg a distance of 115 km. The prices are 1,712,520 kr. and 553,680 kr. respectively.

Tewkesbury.—Town Council. Accepted:—
Alterations in connection with the electric lighting.—Hayward & Sons.

Whitby.
Electric wiring at the new Cottage Hospital.—Mr. T. C. Beecroft.

FORTHCOMING EVENTS.

Commercial Motor Exhibition.—At Olympia, W. November 22nd to December 1st.

Faraday Society.—Monday, November 26th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. From 3 to 5 p.m. Discussions on "Conditions of Equilibrium at Reversible Electrodes," and at 5.30 p.m. on "Irreversible Electrode Effects, including Passivity and Over-voltage."

Northampton Engineering College Engineering Society.—Monday, November 26th. At the College, St. John Street, E.C. Paper on "Management of a Sand and Flint Quarry," by Mr. F. E. A. Manning.

Paisley Association of Engineers.—Tuesday, November 27th. At 39, High Street. At 7.30 p.m. Paper on "Small Plants," by Mr. G. Morrison.

Public Works, Road and Transport Congress and Exhibition.—At the Royal Agricultural Hall, Islington. November 22nd to 29th. November 28th, at 2.30 p.m., paper on "Electrical Strays," by Mr. C. Raphael.

Greenock Association of Electrical Engineers.—Wednesday, November 28th. At 22, West Stewart Street. At 7.45 p.m. Paper on "Wireless Telephony," by Miss Knowles.

Institution of Electrical Engineers.—Thursday, November 29th. At the Institution, Victoria Embankment, W.C.2. At 6 p.m. Joint meeting with the Physical Society of London. Discussion on "Loud-speaking Telephones."

(North-Midland Centre).—Tuesday, November 27th. Paper on "Technical Research, with Special Reference to Electrical Engineering Development," by Mr. W. Wilson.

(South-Midland Centre).—Friday, November 30th. At the Grand Hotel, Birmingham. At 6.30 p.m. Annual dinner.

(North-Eastern Centre).—Monday, November 26th. At the Armstrong College, Newcastle-on-Tyne. At 7.30 p.m. M. Bachellery's paper on "The Electrification of the Midi Railway," to be read by Lt.-Col. O'Brien.

Institution of Mining Engineers.—Thursday, November 29th. At Burlington House, W. Annual general meeting.

Edinburgh Electrical Society.—Friday, November 30th. At the Philosophical Institute, 4, Queen Street. At 8 p.m. Paper, "Some Notes on Generators and Motors," by Mr. G. Henderson.

NOTES.

The Radio Compass.—"The general use of the radio compass, and the adoption of an international radio system will make it impossible for ships to go ashore, and render the danger of collisions at sea during time of fog almost impossible." This claim for his invention was made to the *Evening News* by M. Frederick Kolster, inventor of the radio compass, who is now in London. M. Kolster, who crossed in the *Leviathan* for the purpose of carrying out experiments with his compass, which has been fitted in the liner, said that the test was most successful. They were able during the whole of the voyage to keep in touch with the shore and to know exactly where the ship was. Waves sent out from shore stations and lighthouses are picked up by the navigating officer by means of the radio compass. Ships in future, M. Kolster declared, will be navigated by the officer's sense of hearing.

Appointments Vacant.—Meter repairer, for the Long Eaton Council electricity works; plumber-jointer, for the West Kilbride Electric and Lighting Co., Ltd.; shift engineer, for the Kingston-on-Thames Corporation electricity department; jointer for the Wimbledon Corporation electricity department. (See our advertisement pages to-day.)

Educational.—REGENT STREET POLYTECHNIC PRELIMINARY TECHNICAL SCHOOL.—Prospectuses for the complete course of preparation for boys entering one of the following as a career: Architecture, mechanical and electrical engineering, building and other allied branches of architecture and engineering, can be obtained free on application to the director. (See our advertisement pages to-day.)

New Australian Ignition Device.—A new Australian invention about to be placed on the market is an ignition device for internal combustion engines which, it is claimed, will intensify, and provide a much better spark at the plug points, thereby ensuring complete combustion in the cylinders. It is claimed that the device will save fuel, eliminate the formation of carbon, and make for quicker acceleration and easier starting. The device will be marketed under the name of Blazofyn.—*Reuter's Trade Service* (Melbourne).

Air "Feelers."—The United States Army aviators have demonstrated at Mitchell Field a landing alimeter invented by Arthur W. Uhl, of Brooklyn, and designed to tell the flier of the proximity of obstacles within a radius of 100 feet of his machine. The device consists of plate condensers similar to vacuum tubes working in an oscillating circuit and attached to an indicator in the cockpit.—*Daily Dispatch.*

The Engineers' Club (London).—Annual Meeting.—The second annual general meeting of the Engineers' Club was held on Wednesday, November 14th, and was well attended. The president of the Club, Sir Robert A. Hadfield, D.Sc., F.R.S., in moving the adoption of the report and accounts, congratulated the members on the results, which he thought were surprisingly good in view of the adverse trading conditions which had affected the engineering industry during the past 12 months. Mr. Howard Foulds, chairman of the General Committee, seconded the resolution; he agreed with the president that the results were highly satisfactory, and considered that the Club had successfully passed through the critical stage of the second year of its existence and would, with the united help and support of the members, go on to further prosperity. He specially mentioned the fact that the Club had been enabled to keep the premises, furniture, fittings, &c., in a very high state of repair, and had spent nearly £2,500 on that item alone during the past year. The resolution was carried unanimously.

Sir Robert Hadfield proposed that Sir Joseph W. Isherwood, Bart., M.I.N.A., be elected president of the Club. He mentioned his eminence in the shipbuilding world, and the fact that an enormous tonnage had been built in recent years on the Isherwood system of shipbuilding. Mr. J. B. Whyte seconded the resolution, which was carried with acclamation. Sir T. Harris Spencer, K.B.E., and Mr. C. H. Wordingham, C.B.E., M.Inst.C.E., were elected vice-presidents of the Club.

A very cordial vote of thanks to Sir Robert Hadfield for his services as president during the past year was carried with acclamation, and Sir Robert, in returning thanks, stated that the members could rely upon his doing all he possibly could to further the interests of the Club, which was proving of immense benefit to the whole engineering profession.

In order to fill the vacancy on the Board of Engineers' Club (London), Ltd., caused by the lamented death of Mr. H. T. Wilkinson, Mr. Howard Foulds was elected a director; Mr. Foulds was also appointed honorary treasurer. Mr. Edmund L. Hill was re-appointed honorary secretary of the Club, and, in returning thanks, spoke of the splendid support that had been rendered to him throughout the whole year by every member of the staff. He also stated that there was room in the Club for another 600 or 700 members resident in the United Kingdom in addition to members joining from abroad. Messrs. Vizard, Oldham, Crowder and Cash were reappointed honorary solicitors, and Messrs. Chantrey, Button & Co. were reappointed auditors of the Club. The meeting then terminated.

The Batti-Wallahs.—The re-union luncheon of the Batti-Wallahs' Society will be held at the Hotel Cecil on Wednesday, December 5th, at 1 p.m. Mr. G. W. Partridge, managing director and engineer to the London Electric Supply Corporation, will be the Society's guest on this occasion.

The Society of Technical Engineers.—A public meeting was held in the Milton Hall, Manchester, on November 14th, under the auspices of the Stretford branch of the Society of Technical Engineers, to discuss "The Functions of Staff Councils in Industry." In addition to technical engineers, the meeting was attended by representatives of the accounting and clerical staffs of some of the largest firms in the district, as well as chemists, draughtsmen, and manual workers.

Mr. Laurence H. A. Carr, chairman of the Executive Council of the S.T.E., presided, and opened the meeting with a brief outline of the policy of the Society and the reasons which had prompted it to publish the recent statement; he urged the formation of staff councils, which, he stated, he had reason to believe had the support of several other organisations representative of technical staff workers. The following resolution was then put before the meeting by Mr. Turtle:—"That we welcome the proposals in favour of the establishment of staff councils as set out in the published statement of the Society of Technical Engineers, and while we consider that such councils should be additional and not in substitution of joint industrial boards of staff workers and employers, we believe that they can be made to further and increase efficiency in the firms in which they function, as well as to promote the professional advancement of the members of those staffs."

In proposing the resolution, Mr. Turtle described the working of the Staff Committee at Messrs. Hans Renolds, Ltd. Mr. M. Rawe seconded the resolution, and brought forward evidence to show the satisfactory operation of the Staff Committee at the Metropolitan-Vickers Co.'s works. Mr. Brooks supported the resolution, and emphasised the work that had been done by the S.T.E. in preparing and launching this scheme of staff councils.

Mr. R. Mann asked whether it were not advisable to set up in the first place technical committees in firms representative of technical engineers only. This view was strongly opposed by Mr. Salmon and Mr. Travis, who emphasised the advantages to be gained by the wholehearted co-operation of all the members of the firm's staff. Mr. W. Rostron also deprecated the division of staffs, and discussed the differences between the work of a staff council and that of a trade union as such.

Mr. S. Radcliffe supported the formation of industrial boards as well as of staff councils, but pleaded for unity between the salaried staff and the men on the floor of the shop.

Mr. J. S. Peck expressed the hope that such councils would grow in usefulness.

Mr. Hazleton, Mr. Ping, and Mr. E. P. Hill also spoke in favour of the resolution, which was put to the vote and carried with a single dissentient.

E.D.A. and Proposed Supply.—A town's meeting, convened by Mr. Councillor Richards, was held at the Town Hall, Thame, on November 15th to discuss proposals in connection with the provision of an electricity supply for the town. The meeting was preceded by a lecture by Mr. Victor W. Dale (business manager of the E.D.A.) on "The Uses of Electricity in Home and Business." The chair was taken by Mr. M. Briars (chairman of the Urban District Council), and amongst those present were Viscount Stopford, O.B.E., Mr. W. A. Turnbull, and several members of the Aylesbury Council. Following the lecture a resolution was unanimously passed, recommending the Council to investigate the best means of obtaining a supply as early as possible, one lady in the audience stating that she was willing to put in 100 points at once.

Local Engineering Societies.—Standardisation.—A lecture on "Standardisation in the Engineering Industry," was delivered on November 12th, before the South-Western Centre of the Institution of Post Office Electrical Engineers, at Bristol, by Mr. A. J. Stubbs, whose remarks were more in the nature of a review than of advocacy.

Radio Association of Ireland.—A well-attended and representative general meeting of the Radio Association of Ireland was held at Dublin last week, Mr. J. J. Dowling (National University, Dublin) presiding. Certain additions to the rules put forward by the Executive Committee were unanimously agreed to. The Association's programme was dealt with and the secretary stated that it was the intention of the committee to hold fortnightly meetings for the purpose of lectures, discussions, and, when possible, experimental demonstration and practical work. The membership is increasing satisfactorily and the committee is in communication with interested parties at various centres with a view to forming branches of the Association. A branch has already been formed at Cork, with Mr. R. N. Halliday as honorary branch secretary.

American Marine Exhibition.—The latest developments in engines, ship construction, electrical machinery, steering apparatus, searchlights, and safety devices were among the exhibits at the Annual Marine Exhibition which was opened in New York on November 6th. A feature of the show was the numebr of Diesel engines exhibited. A complete model of a Diesel-electric ship's power plant was installed in the stand of the Westinghouse Electric & Manufacturing Co. The gyroscopic compass, which is being used with success on a number of steamships, was demonstrated on a model of a seagoing vessel. Another exhibit was a searchlight of 40,000,000 candle-power for use on ocean liners, with a beam 30 miles long. The lamp itself is only 18 in. in diameter.—*Reuter's Trade Servic* (New York).

INSTITUTION NOTES.

Institution of Electrical Engineers.—Mersey and North Wales (Liverpool) Centre.—Mr. W. Wilson read his paper on "Industrial Research, with Special Reference to Electrical Engineering Development," at the above Centre on November 19th. The paper was illustrated with lantern slides, and an interesting discussion followed, contributed by Dr. Marchant, and Messrs. Pearce, Collie, Myer, Rettie, Waygood, Holttum, Morton, Devey and Malpas.

South-Midland Centre.—Mr. Wilson also read his paper at this Centre on November 14th; it was received enthusiastically, and the discussion lasted for an hour and a half, Mr. W. F. Higgs, Dr. M. Kahn, Prof. W. Cramp, Mr. F. R. Combe, and Mr. W. Lawson taking part in it.

Scottish Centre.—Members of the Scottish Centre of the Institution held their first meeting of the 1923-24 session in Glasgow, when Mr. R. B. Mitchell, chairman of the Centre, delivered his inaugural address, in which he dealt with the electricity supply business and its future. He pointed out that Chicago used 700 kWh per head of the population per annum, as against only 130 kWh used in Glasgow, and there were very few undertakings in this country which had exceeded the Glasgow figure. The vast possibilities which lay before the electricity supply undertaking in Glasgow in the domestic sphere were indicated by the fact that of the 250,000 dwelling-houses in the city only 14,000 had electricity installed.

Institution of Mining Engineers.—The annual report covering the year ended July 31st last states that the total membership of the Institution at the close of the year was 3,410—a decrease of 22. The accounts show a very satisfactory financial position.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

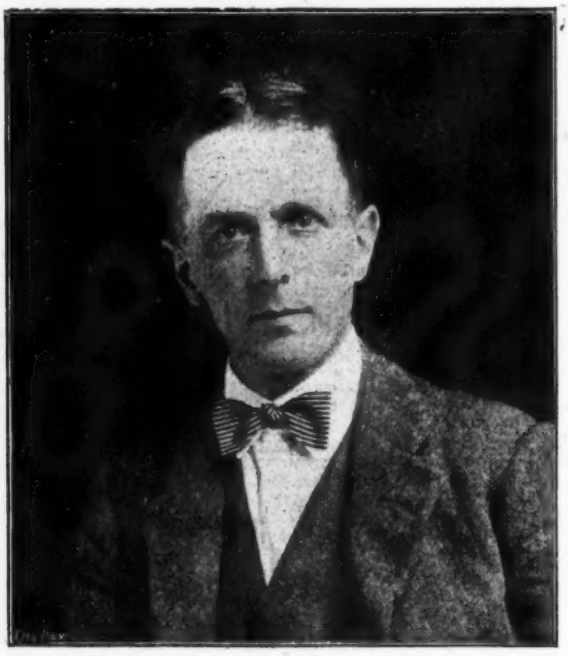
Councillor A. J. Ward has been re-elected chairman of the Electric Supply Committee of the Sheffield City Council, with Alderman R. Styring as vice-chairman.

Mr. A. F. Harrison, of the City of London Electric Lighting Co., Ltd., has been elected president of the Chartered Institute of Secretaries for the ensuing year.

Hackney Borough Council Establishment and General Purposes Committee recommends that the salary of Mr. J. R. J. Bowden, deputy borough electrical engineer, be at the rate of £850 per annum, subject to adjustment quarterly in accordance with the cost of living figure, and that in addition he be paid a sum of £15 per annum in respect of every million kWh sold during any financial year over and above 20,000,000 kWh.

Dover Town Council has appointed Mr. Plater as mains assistant, at a salary of £235 per annum.

Mr. C. T. Allan, who is this session's chairman of the Western Centre of the Institution of Electrical Engineers, is a Yorkshireman by birth; he received his early education at St. John's College, Grimsargh, and the Wakefield Grammar School. Later he was a student at the Finsbury Technical College and the Bradford Technical College. His first practical experience was gained at the works of Messrs. Thomas Howden & Sons, Wakefield. For two years he was engaged



Whitlock & Sons, Ltd.] [*Cardiff.*

Mr C. T. Allan,
Chairman of the Western Centre of the I.E.E.

in electro-chemical research, and then spent four years on the construction and equipment of explosive works, comprising surveying, embankments, cuttings, buildings, and mechanical, electrical and hydraulic equipment. He then joined the Westinghouse Electric & Manufacturing Co., dealing with tramway, railway and industrial equipment in Great Britain and the Continent. After five years with this company Mr. Allan went to the South Wales Electrical Power Co., becoming deputy engineer and manager four years later, a position which he still retains.

Mr. Allan read his inaugural address on October 15th and this was abstracted in our issue of October 26th (p. 637).

Mention is made in our "Business Notes" to-day of the appointment of Mr. W. A. Gillott, A.M.I.E.E., as exhibition manager in connection with the electrical display by the E.D.A. at the British Empire Exhibition.

To celebrate the twenty-fifth anniversary of the opening of the Aberdeen electricity undertaking, Mr. J. Alex. Bell, who has been city electrical engineer from the beginning, was presented with an illuminated address, together with a silver rose bowl for Mrs. Bell.

Alderman John Bedford Burman, the Unionist candidate in the Birmingham parliamentary division of Duddeston, is chairman of the Birmingham Corporation Electric Supply Committee.

On October 4th the Edison Medal for conspicuous achievement in electrical engineering or electrical science was awarded to Prof. R. A. Millikan, of the Californian Institute of Technology. The award was made by Dr. F. B. Jewitt, past-president of the American Institute of Electrical Engineers, by telephone from New York, his speech being rendered audible to a large audience by means of a "public address" system.

Sir Allan Smith, M.P., before the dissolution of Parliament resigned his chairmanship of the Industrial Group of Members of Parliament, and Sir Edward Manville was elected in his stead. It was understood that Sir Allan was not in accord with the Government with regard to its policy for dealing with unemployment. Sir Allan will stand as a Unionist candidate for Partick (Glasgow) constituency.

Stepney Borough Council General Purposes, Staff and Education Committee, having further considered the Council's reference back of its recommendation of payment as from March, 1921, of annual sums of £100 and £25 out of the funds of the electricity supply undertaking to Mr. B. J. Belsher (borough engineer and surveyor), and to Mr. W. B. Stuttle (principal engineering assistant), respectively, in recognition of the services rendered by them to the undertaking, and has also considered the Council's instruction as to the remuneration of the borough engineer and surveyor and his principal engineering assistant for all their services to the borough, and recommends that the salary of the borough engineer and surveyor be increased as from April 1st, 1923, from £1,100 to £1,250 per annum, £100 of which is to be contributed from the funds of the electricity undertaking, such salary to cover remuneration for all services rendered. The case of Mr. Stuttle is deferred until a subsequent meeting.

Mr. C. McArthur Butler has just completed 25 years' official connection with the Society of Architects, of which he is secretary. Our readers will remember Mr. Butler, as also being secretary of the I.M.E.A. for some years during that period.

The *Industrial Australian* states that Mr. W. Corin, chief electrical engineer of the New South Wales Public Works Department, has resigned, in order to enter into private practice as a consulting engineer, after 15¼ years in the New South Wales Government service. Mr. R. V. Morse, who is principal assistant to Mr. Corin, will act as chief electrical engineer pending a permanent appointment being made, and may permanently succeed to the position. Mr. Corin has been appointed consulting engineer to the Cairns Hydro-Electric Investigation Board, in Queensland, and will act for two New South Wales municipalities. His headquarters will be in Sydney.

The *South African Engineer and Mining Journal*, for October 27th, stated that Messrs. B. Price and C. H. Merz had left on their return to England, and that Mr. F. W. Mills, chief electrical engineer to the S.A.R., was also on his way to this country.

Mr. J. Huxley, late of the Liverpool branch of the General Electric Co., Ltd., has been appointed an outside representative of Electric Lamp Factors, Ltd., at their Liverpool branch.

Wills.—The late Sir Albert Hobson, of Sheffield, left £139,660 net personalty. The bequests include £5,000, and the ultimate residue, after providing for various legacies, to Sheffield University.

Mr. J. W. Breeze, electrical engineer of Sutton, left £7,238.

NEW COMPANIES REGISTERED.

Never-Stop Railway (Wembley), Ltd. (193,695).—Private company. Registered November 12th. Capital, £1,000 in 10,000 "A" ordinary and 10,000 "B" ordinary shares of 1s. each. To carry into effect an agreement intended to be made between the British Empire Exhibition (1924). Incorporated, of the one part, and Never-Stop Transit, Ltd., of the other part, to acquire a licence from Never-Stop Transit, Ltd., to work a railway in the grounds of the British Empire Exhibition (1924), to take over the rights obtained by Never-Stop Transit, Ltd., from the British Empire Exhibition (1924), Incorporated; to construct, equip, operate, and maintain such railway, &c. The British Empire Exhibition (1924), Incorporated, may appoint one-third of the directors, subject to which the holders of the "A" ordinary shares may elect one half and the holders of the "B" ordinary shares the remaining half of the directors. The first directors are:—W. C. Bersey, 16, Grosvenor Gardens, S.W.1 (controller of Stadium and Entertainments at British Empire Exhibition); A. G. Chuter, 22, Highbrow Road, Ealing, W.13 (finance manager, British Empire Exhibition); Col. Clive G. Liddell, C.M.G., C.B.E., D.S.O., "Spokane," Manor Road, Aldershot; J. R. Milne, 50, Pall Mall, S.W.1; D. M. Anderson, O.B.E., Dalmarnock Iron Works, Glasgow, N.B. (director of Sir Wm. Arrol & Co., Ltd.); J. H. Stead, "Hawthorn," Hillside Gardens, Wallington, Surrey (director, Drury Car Co., Ltd.); Sir Harry S. Foster, Kt., 82, Victoria Street, S.W.1; W. Y. Lewis, 33, Park Road, Southend-on-Sea (director of Never-Stop Transit, Ltd.); J. E. Bembaron, 14, Craven Hill Gardens, W.2 (director, Never-Stop Transit, Ltd.). Remuneration, £100 each per annum (chairman £50 extra). Registered office: "Sardinia House," Kingsway, W.C.2.

H. C. Phillips & Sons, Ltd. (193,726).—Private company. Registered November 13th. Capital, £1,000 in £1 shares. To carry on the business of manufacturers of wireless accessories, &c. The subscribers (each with 1 share) are:—H. C. Phillips, 31, Dowsett Avenue, Southend-on-Sea, accountant; L. G. Wilkinson, "Beechcroft," Milton Road, Harpenden, varnish manufacturer; L. J. Genin, 6, Weston Road, Southend-on-Sea, agent; B. E. Rowe, 101, Arsenal Road, Eltham, S.E.9, engineer. The first directors are:—H. C. Phillips and G. H. F. Phillips. Qualification, 100 shares.

London and Provincial Radio Co., Ltd. (193,674).—Private company. Registered November 10th. Capital, £1,000 in £1 shares. To carry on the business of wireless, electrical, mechanical, and general engineers, manufacturers of, and dealers in wireless and radio instruments, transformers, &c. The first directors are:—E. Duckworth, "Highcliffe," Colne, Lancs., electrical and scientific instrument maker; H. Wilkinson, 25, Bridge Street, Colne, Lancs., electrical engineer; A. Tindall, 145, Cotton Tree Lane, Colne, Lancs., electrical engineer. (E. Duckworth is governing director, subject to holding 100 shares, with power to appoint and remove other directors.) Qualification of directors, 1 share. Remuneration as fixed by the company. Registered office: 22a, Colne Lane, Colne, Lancs.

W. A. Saxby & Co., Ltd. (193,775).—Private company. Registered November 15th. Capital, £1,000 in £1 shares. To carry on the business of manufacturers and assemblers of, and dealers in plant, machinery, apparatus, and tools of all kinds for the generation, transmission, reception, and storage of electricity or electric power, with or without the use of wires, cables, or other conductors, &c. The first directors are:—W. A. Saxby, "The Greenway," Whitton Road, Hounslow; E. R. Parsons, Station Drive, Watchet, Bucks.; E. G. A. Williams, 249, Kennington Road, S.E.11. Registered office: 3-5, Gayford Road, Shepherd's Bush, W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Tele-Dis Services (Founders Co.), Ltd.—Mortgage dated October 5th, 1923, to secure £500 and further advances (if any) charged on 71, Newington Causeway, S.E. Holders:—Kensington Co-operative Banking Society, Ltd., 17, Kensington Park Road, S.W.

International Electric Co., Ltd.—Trust deed dated November 7th, 1923, as collateral security for £70,500 already registered, charged on certain freehold land, building, plant, &c., at Tottenham Hale, N. Trustees:—H. E. Gleave and S. Pope, 8, Cook Street, Liverpool.

Taylor's Radio Electric, Ltd.—Debenture dated November 6th, 1923, to secure £1,850 and all moneys due or to become due to the company's bankers charged on the company's undertaking and property, present and future, including uncalled capital. Holders:—E. Horley, 67, Queen Street, Cardiff; and F. B. Taylor, 146, King's Road, Cardiff.

Midland Valves, Ltd.—Debenture dated November 7th, 1923, to secure £600, charged on the company's undertaking and property, present and future, including uncalled capital. Holder:—R. H. Byerley, 14, Victoria Road, Broomhill Park, Sheffield.

Radio, Phonopore, and Electricals, Ltd.—Satisfaction in full on October 4th, of debentures dated March 31st, 1923, securing £3,000.

Cross & Cross, Ltd. (105,754).—Return dated June 26th, 1923. Capital, £20,000 in £1 shares. 10,000 shares taken up. £4,845 paid. £5,155 considered as paid. Mortgages and charges, nil.

British Arc Welding Co., Ltd. (108,759).—Return dated August 9th, 1923. Capital, £50,000 in £10 shares. 1,474 shares taken up. £12,740 paid. £2,000 considered as paid. Mortgages and charges, nil.

Allen, West & Co., Ltd. (108,870).—Return dated October 23rd, 1923. Capital, £150,000 in £1 shares. 141,724 shares taken up. £141,724 paid. Mortgages and charges, £100,000.

Direct West India Cable Co., Ltd. (53,956).—Return dated October 4th, 1923. Capital, £120,000 in £5 shares. 12,000 shares taken up. £60,000 paid. Mortgages and charges, nil.

Exchange Telegraph Co., Ltd. (6,152).—Return dated October 11th, 1923. Capital, £96,450 in 8,023 "A" shares of £10 each and 16,200 "B" shares of £1 each. All shares taken up. £10 per share called up on 8,000 "A" and £2 per share on 2,023 "A" shares. £64,046 paid. £62,384 considered as paid, being £1 per share on 16,200 "B" shares and £6 per share on 2,023 "A" shares. Mortgages and charges, nil.

CITY NOTES.

Para Electric Railways and Lighting Co., Ltd.

A meeting of holders of the 5 per cent. debenture stock of the company was held on November 19th, Mr. A. H. Wynn, chairman of the trustee company, presiding. The chairman of the company, Mr. Follett Holt, said that the aid of the stockholders in tiding over the temporary difficulties with which the company was faced was being sought. These difficulties were entirely due to the unprecedented fall in the exchange value of the milreis. It was proposed that, beginning with the half-yearly dividend due on December 1st next, interest during a period of three years should be payable out of available cash resources only after making provision for certain charges which must be met to protect the enterprise as a going concern. Interest at the rate of 7 per cent. per annum would be paid on arrears of debenture interest, and sinking-fund payments would be suspended, if necessary, for a similar period. The stockholders would resume their full rights at the end of the three-year period; a special debenture interest and sinking fund protection fund would be created. After discussion on a number of points, the proposals were approved.

India Rubber, Gutta Percha, and Telegraph Works Co., Ltd.

The directors' report for the year ending August 31st, 1923, shows a net profit of £96,344, plus £3,592 brought forward, making £99,936. After providing for the preference dividends paid in January and July, £12,500, and adding £39,278 to reserve fund, there is a disposable balance of £48,158, out of which a dividend of 5 per cent., free of income tax, on the ordinary shares is to be paid, requiring £37,500, and leaving £10,658 to be carried forward. "Apart from the excess profits duty refund, the accounts of the company show that the gradual improvement of the position, as referred to in the communication to the shareholders of June 16th last, has been maintained. Your directors have carefully considered, with your auditors, the position of the assets in France arising out of the wide variation from the normal rate of exchange between France and London, and in the best interests of the shareholders have raised the reserve fund to £180,000." Meeting: November 29th, at 106, Cannon Street, E.C.

German Companies.

The *Bavarian Telephone Co.*, of Munich, has decided not to make any distribution for the year 1922-23, but to carry forward the net profits of 419.19 millions of marks.

The *Rheydt Cable Works Co.*, of Rheydt, reports that the undertaking was sufficiently employed in 1922-23, although the number of orders was reduced in consequence of the occupation of the Ruhr. The net profits amounted to 525.48 millions of marks, as compared with 18.83 millions in the preceding year, but no provision has been made for depreciation in 1922-23, and no dividend is proposed so as to strengthen the position of the company.

The report of *Garbe, Lahmeyer & Co.*, of Aix-la-Chapelle, states that the decline in orders which was recorded a year ago continued in 1922-23 and more recently became accentuated so that the directors were compelled to operate all the departments on short time. Orders for foreign account continue to be lacking owing to the unstable economic conditions prevailing in Germany. After having made provision for depreciation, the accounts show net profits of 286.4 millions of marks, as compared with 3.6 millions in 1921-22, and the dividend is at the rate of 5,000 per cent. and 120 per cent. in the two years respectively.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Stock Exchange Committee under Rule 159:—

Urban Electric Supply Co.—100,000 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 550,001 to 650,000.

The undermentioned have been ordered to be officially quoted:—

London Electric Supply Corporation.—55,500 ordinary shares of £3 each, fully paid (Nos. 111,001 to 166,500).

Montreal Tramways Co.—A quarterly dividend of 2½ per cent. is announced.

Adelaide Electric Supply Co., Ltd.—Final dividend on ordinary shares of 6 per cent., free of British tax, making 12 per cent.

Argentine Light and Power Co.—Interim dividend on the preference shares at the rate of 7 per cent. per annum (less tax) in respect of the half-year ended September 30th.

Chloride Electrical Storage Co., Ltd.—Interim dividend of 5 per cent. actual, less tax, on the ordinary shares.

British Electric Traction Co., Ltd.—Interim dividend of 2 per cent. on the ordinary stock.

STOCKS AND SHARES.

TUESDAY EVENING.

THE principal event of the present week, from the point of view of those who are interested in electricity issues, is the publication of details respecting the legislation that is to be brought forward by the London supply companies to give legal effect to the proposals of the L.C.C. with reference to the settlement of that body with the London companies. The Council agreed that, provided a satisfactory sliding scale of prices and dividends could be arranged, the London supply companies should be empowered to amalgamate and be granted an extension of their lives to 1971, that is to say, forty years beyond the date fixed at present for their individual existence. This is the hope upon which attention has been focused for a long time past, and to which constant reference has been made in these paragraphs.

In order to give effect to the settlement that has been reached between the two parties, the L.C.C. and the London companies, a fresh Bill must be obtained from Parliament, and the first step to this end is the publication of the statutory notice mentioned above. Its effect has been slight, so far as prices of shares in this market are concerned, the reason being, of course, that people are too much absorbed by political affairs nowadays for them to take much notice of what is going on in financial circles. Besides this, prices have risen substantially in the expectation of this stage being reached, the matter having been fully ventilated here as well as in other columns.

Everything has been done to safeguard the interests of all those who are concerned: the consumers, the public, and the companies themselves. The granting of a Bill would make an important contribution to the unemployment problem, in that it would set free the companies from their present necessarily cautious attitude in the direction of extension or development work. It may be some time, of course, before the necessary powers are obtained, and, con-

ceivably, opposition will have to be surmounted, though for those who realise the position, financially and economically, this extra forty years' tenure to the supply companies' lives would be of substantial service in many directions. It was but lately that one of the best-known bank directors was girding at the prices, far too high in his opinion, of electric power in London. The lengthening of the companies' lives, together with the permission to amalgamate which the new Bill will propose, could not fail to have the effect of cheapening electric power and of bringing London more into line with some of the other big cities in the world where the question of cheap current has already been settled.

Charing Cross shares are a little lower at 12¾, London Electrics have gone back to 4 15/16, and the market as a whole is quiet. Bournemouth & Poole are up to 39s. 6d., on the proposal to increase the capital of the company by the creation of more ordinary and preference shares. Other provincial issues are steady, with not much trade. Indeed, business in the electricity supply market as a whole is quiet, in consequence of the political ferment of the times.

Para Electric debenture stock has dropped sharply to the nominal price of 42, on the announcement from the directors that the company is unable to meet either the full half-year's interest or the instalment of sinking-fund on the 5 per cent. debenture stock, due on December 1st next. A meeting was held on Monday in this week, at which the proposal was put forward that, beginning with the instalment due on the first of next month, interest on the debenture stock shall only be payable when resources permit, and that any interest not paid on the due date shall carry interest at the rate of 7 per cent. It was further proposed that the sinking-fund should be suspended for three years unless funds were available. These proposals were duly carried by the shareholders, after some discussion had taken place concerning the present position and the prospects of the company. The whole trouble has arisen through the depreciation of the Brazilian milreis.

The drop in sterling as compared with the value of the dollar is bringing about big rises in the prices of Stock securities, the interest on which is paid in dollars. For example, American Telephone bonds have risen nearly 10 points to 145, and the various shares of the American and Canadian electricity companies have advanced in most cases. The movements are due, of course, largely to a mechanical marking-up of values, for these bonds, which are affected by the American rate, do not change hands with any degree of freedom. The prices are advanced to bring them into relation with New York quotations, and America is usually a buyer of these stocks.

The political uncertainty is responsible for the heaviness which prevails amongst cable stocks, where Eastern Extensions, Globes and Eastern Telegraph ordinary are all lower on the week. It is not so much that stock has been pressed for sale which causes the dulness, but the fact that buyers are holding off. Anglo-Americans keep steady, and as already mentioned, dollar stocks are better by reason of the fall in the cable rate. Jutland Telephone bonds drooped to 99; United River Plate Telephones to 6¾.

In the manufacturing lists, Henley's eased off to 2 7/16. India Rubber shares rose half-a-crown, on the satisfactory showing made by the report, which shows how a loss in one year can be turned into a profit in the next. The company is to pay a dividend of 5 per cent., free of tax, and the figures just published are distinctly encouraging. The preference recovered to 15s. English Electrics gave way a trifle, while General Electrics are a shade harder at 19s. 6d. Electric Constructions regained the dividend of 7 1/5d. without alteration of price. Enfield Cable 7½ per cent. preference, with 10s. paid, are a little lower at 9s.

Home Railway stocks are humdrum, Districts being the only one in the group to show any alteration. A fall of 10s. lowered the price to 53½. Metropolitans are unable to shake off their weakness. London & Suburban Traction preference have given way to 8s. British Electric Traction ordinary rallied to 71½, on the absorption of two or three lines of deceased account stock which happened to come to market simultaneously. Anglo-Argentine Tramways shares are better, the first preference showing a rise of 3/16, while the seconds gained 10s. It is rumoured that the company has come to terms with the Buenos Aires Municipality on the question of fares, and that the settlement is on more favourable lines than had been expected from the point of view of the company, though the Municipality also stands to score through the new extension which the company will be able to put in hand for handling the constantly increasing traffic. Mexicans are heavy, and British Columbia stocks are better on hopes of a good report in a month's time. In Quebec Power debenture stock a market began on Tuesday morning, when the price, after opening at 3¼ premium, fell back a little to 2¼ premium. Allotments were on a very modest scale, the issue having been heavily over-subscribed. The new Tata Power Company's debentures "A" and "B" both fell to 3½ discount before recovering to 3 discount.

The iron and steel market, together with that for armament shares, is again a trifle harder, on the impression that Protection, if introduced, would benefit the industries concerned. Rubber shares are inanimate, and there is nothing doing in them. Business throughout the Stock Exchange suffers interference through the incidence of the General Election campaign.

SHARE LIST OF ELECTRICAL COMPANIES.

	Nom.	Dividend. 1921.	Dividend. 1922.	Price Nov. 20, 1923.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.						
Brompton Ordinary	£ 1	12	12	29½	—	40 12 0
Charing Cross Ordinary	5	9	14	12¾	— ¼	5 11 0
do. do. do. 4½ Pref.	5	4½	4½	4 15/16	—	5 4 4
Chelsea	1	6	10	20/-	— 2/-	5 11 1
City of London	1	14	15	2 9	—	6 0 0
do. do. 6 % Pref. ...	1	6	6	24/-	—	5 4 4
County of London	1	8	10	2 1/8	—	4 16 10
do. do. 6 % Pref. ...	1	6	6	22/3	—	5 7 8
Edmundson's Ordinary	5	Nil	7	4¾	— ⅛	5 4 10
do, 6 % Pref	5	12/-	6	5¾	+ ¼	5 11 7
Kensington Ordinary	5	10	12	10½	—	5 18 5
London Electric	3	4	10	5	—	5 19 9
do. do. 6 % Pref. ...	5	6	6	5½	—	5 9 1
Metropolitan	1	7	8½	1¾	—	5 4 7
do. 4½ % Pref.	1	4½	4½	17/6	—	5 2 10
Newcastle-on-Tyne Ordinary ...	1	Nil	2½	15/-	—	3 6 8
do. 5 % Pref. ...	1	5	5	18/9	—	6 7 0
do. 7 % Pref. ...	1	7	7	23/-	—	6 1 9
Notting Hill 6 % Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6 % Pref. ...	1	6	6	22/-	—	5 9 1
Urban Ordinary	1	Nil	—	17/-	+9d.	Nil
do. 5 % Pref. ...	1	2½	5	¾	—	6 17 0
St. James' and Pall Mall ...	5	12	14½	11⅝	—	6 2 1
South London	1	7	10	1 1/16	—	5 3 3
South Metropolitan Pref. ...	1	7	7	24/6	—	5 14 8
Westminster Ordinary	5	10	12	10¾	—	5 17 3
Whitehall Elec. Invst., 7½ % Pf.	1	7½	7½	19/9	—3d.	7 12 0
HOME RAILS.						
Central London Ord. Assented Stock	4	4	7⅛	—		5 9 7
Metropolitan ... ... ,,	2¼	3½	7 1/16	—		4 14 0
do. District ... ... ,,	1	3	5 3/16	—¼		5 12 1
Underground Electric Ordinary	10	Nil	Nil	8¾	—	Nil
do. do. "A" ...	1	Nil	Nil	9/-	—	Nil
do. do. Income Bonds	4	5	100	—		*5 0 0
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref. ... ... Stock	6	6	103	—		5 16 6
do. Def. ... ... ,,	1½	34/6	23½	—		6 9 0
Chile Telephone	5	6	6	6	—	5 0 0
Cuba Sub. Ord.	10	7	7	7½	—	9 13 3
Eastern Extension	10	10	10	16½	— ¼	5 19 5
Eastern Tel. Ord. ... ... Stock	10	10	10	168	—2½	5 19 1
Globe Tel. and T. Ord.	10	10	10	17⅜	— ¼	5 15 1
do. do. Pref.	10	6	6	11½	—	5 7 7
Great Northern Tel.	10	24	22	28	—	7 17 3
Indo-European	25	10	7	31½	—	*5 11 1
Marconi	1	25	15	2 1/16	—	6 17 0
Oriental Telephone Ord. ...	1	12	12	1⅝	—	*6 6 0
United R. Plate Tel.	5	8	8	6¾	— ¼	*5 16 4
West India and Panama ...	10	Nil	Nil	1/-	—	Nil
Western Telegraph	10	10	10	17	—	*5 17 8
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams. First Pref.	5	5½	12½	8½	+ 1/16	8 16 0
do. do. 2nd Pref.	5	Nil	5½	3½	+ ¼	9 16 0
do. do. 5% Deb.	Stock	5	5	70½	—	6 10 9
British Electric Traction Ord.	,,	4½	5	71½	+1	6 19 10
do. do. 6% Pref.	,,	6	6	101½	—	5 18 3
Brazil Tractions	100	Nil	4	42	—	9 10 6
Brit. Columbia Elec. Rly. Pcs.	Stock	5	5	84½	—	5 18 4
do. do. Preferred	,,	5	9/6	83½	—	*5 15 1
do. do. Deferred	,,	5	127/-	97½	+2	*6 9 9
do. do. Deb. ...	,,	4½	4½	77½	—1	5 9 8
Lond. & Sub. Trac. 5 % Pref.	1	3½	5	9'-	—6d.	12 10 0
London United Tram. Deb. ...	Stock	4	4	59	—	6 18 4
Mexico Trams. 5 % Bonds ...	—	Nil	Nil	70½	—	6 10 9
do. 6 % Bonds ...	—	Nil	Nil	83½	—	Nil
Mexican Light Common ...	100	Nil	Nil	24	—	Nil
do. Pref.	100	Nil	Nil	59½	—	Nil
do. 1st Bonds ...	—	Nil	5	67½	—1	7 8 0
MANUFACTURING COMPANIES.						
Babcock & Wilcox	1	15	20	2 1/16	—	*4 10 1
British Aluminium Ord. ...	1	10	5	17/6	—9d.	5 14 3
British Insulated Ord.	1	15	15	9½	—	6 0 0
Callenders	1	15	15	49/6	—	6 1 3
do. 6½ Pref.	1	6½	6½	25/-	—	5 4 0
Crompton Ord.	1	10	5	¾	—	10 0 0
Edison-Swan	1	10	Nil	4/8	—	Nil
do. do. 5% Deb.	Stock	5	5	66	—	7 18 10
Electric Construction	1	10	10	29/6xd	+6d.	6 15 7
English Electric	1	8	5	17/9	—6d.	5 19 7
do. do. Pref.	1	6	6	19/6	+6d.	6 3 1
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 3
do. Ord	1	10	5	19/6	+3d.	5 2 7
Henley	1	15	15	2 7/16	— 1/16	6 3 0
do. 4½ Pref.	5	4½	4½	4½	—	5 2 10
India-Rubber	1	10	—	13/9	+ ¼	*7 5 6
Met.-Vickers Pref.	3	8	8	2½	+ 1/16	5 19 9
Siemens Ord.	1	10	10	15/-	—	Nil
Telegraph Con.	12	20	20	26	—	*5 0 0

* Dividends paid free of Income Tax.

ACCURATE METERING.

By S. H. RICHARDS, A.M.I.E.E.

(*Concluded from page 728.*)

4.—Choice of Meter.

The choice of a meter may, at one and the same time, be either an easy or a difficult matter. To advertise for tenders and to choose the cheapest type is a simple method, but one which may involve the undertaking ultimately in heavy losses and large overhead charges, for when the cheapest meter has been chosen on a capital economy basis, it invariably happens that periodic examination and repair have to be conducted more frequently and cause such a large increase in the current expenditure as to make the "cheap" meter more expensive and unprofitable than the meter whose initial cost has been greater.

The more difficult method, the choice of a type as standard for service conditions, smallest losses and overhead charges, involves much patient research both in and out of the test room.

Before definitely deciding upon a type as standard, it is advisable to obtain samples of various well-known makes and subject them to a series of tests in the test room. The tests usually taken are:—

1. Curve test from 1/20 load to 25 per cent. overload.
2. Dial test for accuracy of dial.
3. Its ease of repair.
4. Insulation test (resistance and flash test).
5. Absence of "shunt creep."
6. Balance of elements (polyphase and three-wire).
7. Variation with change of temperature.
8. Variation with change of pressure.
9. Variation with change of frequency.
10. Variation with change of power factor from unity to 0.3 leading or (and) lagging.
11. Travel test.
12. Ageing test.
13. Torque at full load.
14. Shunt losses.
15. Series losses.

A close inspection should also be made of the construction of the meter in relation to:—

1. Its suitability for the service conditions.
2. Its finish.
3. Starting current.

With d.c. commutator meters it is advisable to take the initial test beginning with the 1/20th load to 25 per cent. overload and then reverse from the overload to 1/20 load in order that a correct idea of the possibility of accurate registration may be ensured. This is essential, as oxidation of the commutator and brushes may be sufficient seriously to affect the accuracy of this type of meter and, as circuit conditions are not such as to guarantee starting loads approaching full load, it is obvious that the "skin" effect of the brushes and commutator will affect registration on circuit to a greater degree than during laboratory tests, unless a safeguard is adopted as suggested.

The curves included in fig. 3 were taken on a d.c. commutator meter in a country where the humidity was high, and were obtained with an interval of less than seven days between the tests. Curve I shows fairly accurate registration from 1/10th load to full load. Curve II shows what would have happened on circuit had this type of meter been installed.

5.—Routine Testing.

When preliminary testing has been concluded, the testing of a meter may be divided into—

(1) Initial test (on receipt from manufacturer).
(2) Site test.
(3) Challenge test.
(4) Referee test.

Initial testing of meters need not be as comprehensive and complete as the testing carried out during examination for suitability of type, but as a safeguard it is advisable to carry out a type test on one or two per cent. The following are the usual tests, and are recommended as sufficient for all practical purposes:—

(1) Starting current.
(2) Curve tests, 1/20th, 1/10th, ½, and full load.
(3) Accuracy of dial reading.
(4) Power factor test at 0.5 lagging.

When a conclusion has been formed as to the meter best suited for the supply, and orders have been placed, the meter authority (from the day the meter is connected on circuit) must be prepared to make periodic visits for tests on "site" in order that he may convince himself that the meters are working in accordance with sample.

Site tests, when needed to check the accuracy of the meter, are sufficient if taken at 1/20th load and the normal working load of the meter.

Challenge and referee testing necessitate accuracies throughout the range being obtained, and tests Nos. (1), (2), (3), and (10), given in the list of preliminary tests, are needed.

The question now arises as to how long a meter can

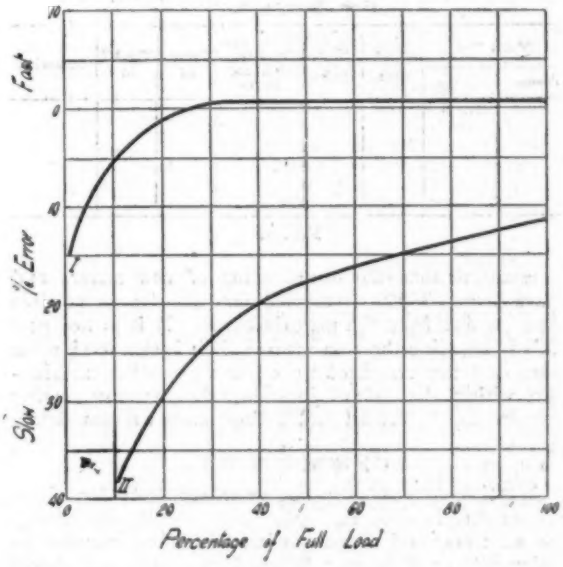


Fig. 3.

remain on circuit before it is removed for examination, cleaning, and recalibration. This can only be answered by the "man on the spot," as the conditions vary not only in different countries, but also in different towns. Speaking generally, it may be said that in countries where conditions are similar to those in Great Britain, a period of 3 to 5 years may elapse before a meter is removed from circuit, but in tropical countries, where humidity is great, many supply authorities insist on changing their meters every two years.

6.—Records.

It cannot be too strongly emphasised that a meter running slow means lost revenue, even if it is recording within the specified limits.

Accurate testing produces better meter accuracies and results in the recovery of lost units, contented consumers, and an advance in the number of connections to the mains. Accurate metering in itself, however, is

insufficient without an accurate system of recording tests and all questions relating to the testing and commercial operation of meters, since it is only by keeping a life history that it is possible to trace a difficulty or defect to its source. Records are necessary, and the problem of accurately recording the history of a meter from the date of its receipt from the manufacturer to the time when its useful life has finished needs careful consideration, for a systematic record precludes the possibility of error, and a true value of the meter in service is obtained.

An essential section of a testing department is the staff, which is responsible for the recording of stocks, new meters, and spare parts, the dispatching of meters, receiving back faulty meters or meters changed for cleaning, and reporting all the necessary information to the inspection and commercial departments.

A meter department's book-keeping may therefore be divided into:—

(1) Transactions between the supply authority and the maker.

(2) Records of tests.

(3) Transactions between the "test" and the "commercial" and "inspection" departments.

(1) Transactions between the Supply Authority and the Maker.

When new meters or spare parts are received, they should be examined as soon as possible and entered in a new meter or spare parts' book, as shown in fig. 4. One series of books only need be printed and one used for spare parts by utilising the meter number columns for the number of parts actually received. It

New Meter Book.

Meter No.		Date of Rect.	Date of Exam.	Maker and Condition or Spare Parts.	Exam. by	Check'd by	Remarks.
Owner.	Maker.						

Fig. 4.

is essential that the examination of new meters and spare parts should be carried out as soon as possible after receipt from the manufacturer. If it is not possible to examine these on arrival, it is better to sign for them as "not examined," and carry out the examination within three days in order that damage during transit may be traced and claims made without delay.

(2) Records of Tests.

A satisfactory system for recording tests for either a.c. or d.c. is given in fig. 5. These books are suitable for all tests, and in connection with these volumes an index volume of meter numbers is necessary and should be kept. Against the number of each meter is recorded

Meter Test Records.

Number.		Date of Test.	A.C. or D.C.	Amps.	Volts.	Periods.	Insulation test.	Starting Current.	Torque.	Accuracy Test. Percentage Error.					At Power Factor.	Load Test.	Dial Test.	Check'd by	Tester.	Remarks.
Owner.	Maker.									1/1	½	¼	1/10	1/20						

Fig. 5, Foolscap.

the volume and page on which the test is found, as follows:—

Owner's No.

34,789. III/12. IV/16. VII/149.

The Roman numerals indicate the volume in which tests relating to meter No. 34,789 are found, and the ordinary numerals are the page numbers in the volume.

By this means the tests on any meter may be turned up in a moment and (with the system of card indexing referred to later) the history of a meter may be traced and conclusions based on the actual recorded facts.

A repair book is shown in fig. 6, and this system

Repair Book.

Meter No.		Date.	Repairer.	Nature of Repair.	Spare Parts.	Completed.	Certified.	Remarks.
Owner.	Maker.							

Fig. 6.

Meters Fixed on Circuit.

Meter No.		Date.	Address.	Name.	Reading.	Checked by	Fixed by	Remarks.
Owner.	Maker.							

Fig. 7.

Meters Removed from Circuit.

Meter No.		Date.	Address.	Name.	Removal reading.	Checked by	Removed by	Remarks.
Owner.	Maker.							

Fig. 8.

Report Book between { Commercial and Inspection } Depts. and Test Dept.

Date.	Address.	Name	Meter removed.						Meter fixed.				
			No.	Amps.	Volts.	~	Reading.	Reason for remvl.	No.	Amps.	Volts.	~	Reading.

Fig. 9.

keeps a check upon the spare parts used and the accuracy of repair.

The method of recording meters fixed or removed from circuit and reported to the inspection department is given in figs. 7, 8, and 9. These books are self-explanatory.

Index cards, figs. 10 and 11, are used for the history of a meter's life on circuit, and also a history of the meters connected from time time on any particular premises. The card shown in fig. 10 is indexed under the owner's number and is in numerical order, while card, fig. 11, is indexed under an alphabetical and numerical record, alphabetical in relation to the street, and

Meter No. { Owner.....
Maker..... Amps..... Volts..... ~.....

Date of receipt from Manufacturer. { ..... Condition.....
....

Date.	Address.	Test Record.	Reading.	Remarks.

Meter History Card 5" × 3"

Fig. 10.

.... { Street or Road. Con's. Name..... Date.....
....
....
....

Meter No.	Fixed date.	Reading.	Removed. Date.	Reading.	Replaced by	Remarks.

Printed both sides. House History Card 5" × 3"

Fig. 11.

numerical in relation to the number in the street. This card index system may be looked upon as superfluous, but in actual use has been the means of checking—

(1) Defects of meters which have not developed in test.
(2) Stoppages on circuit.
(3) Abnormal developments in occupied premises.

(3) Transactions between Departments.

The system of reports between the test department and the inspection and commercial departments should follow a definite cycle. When complaints are received from consumers relating to abnormal consumption or reports have been received from the inspection department relating to abnormal occurrences on circuit, it is preferable and advisable that the commercial department should first investigate the series of complaints before the test department is called upon to take up the position of either arbitrator or tester.

It is essential that difficulties should be met with courtesy and integrity in order that the consumer may feel that his complaint, however wild and improbable it may seem, is one in which you are prepared to meet him at all points and satisfy him by an assurance that the work is being carried out in his interest as well as in the interest of the company. In this way the harmonious working of the supply undertaking with its constituency can be assured.

An indication has been given of the type of books essential to the satisfactory working of a testing department. Complete accuracy is only possible where attention to detail is closely scrutinised both in testing (instruments and meters) and in recording every phase of the procedure adopted.

RUSSIAN ELECTRICAL NOTES.

Electricity in the Moscow District.

The president of the Moges, in an interview with a correspondent of a Moscow journal on the prospects of electrification in Moscow in the current (1923-24) working year, said that both with regard to the condition of the existing power stations and the supply of fuel, the prospects of providing the population of Moscow and the Moscow industries with electricity during the year appeared to be quite satisfactory. Considerable repair and extension of equipment had been carried out in the electrical stations composing the Moges series for the first time after a long idle period following upon the foreign and civil wars.

At the Moscow station, formerly owned by the 1886 company, a turbo-generator of 10,000 kW capacity, received from abroad, was installed. This was the first set of such power erected in the station since 1914. In a short time a new steam boiler of 1,400 square metres heating surface is expected to arrive from Scotland, from the Babcock & Wilcox factory. The installation of this new set will not only increase the power of the Moscow station, but it will make it possible to effect considerable economy in petroleum fuel consumption.

As to other stations of the Moges, a conversion of the stoking principle in the boilers to the chain system was carried out. Chain grate stokers have been installed at the Elektroperedatch establishment, greatly increasing the boiler efficiency.

New transformers are being installed at the Izmailovsk substation and the Elektroperedatch station, which will increase the supply to Moscow. The total power of the Moges stations on October 1st, 1923, amounted to 90,000 kW, excluding the new turbines. The energy supplied during the past working year by the Moscow town and district systems for lighting and industry, not counting the tramway service, amounted to about 150,000,000 kWh, which exceeded the 1916 figure by 10,000,000 kWh. The number of consumers during the recent revolutionary years has increased from 80,000 to 160,000.

The supply is distributed as follows:—48 per cent. for industry, including 3 per cent. for private industrialists, and the rest for Government requirements; 35 per cent. for lighting; and 17 per cent. for tramways.

The fuel used in the Moscow Government power station is partly petroleum and partly coal, whilst the regional stations work exclusively on peat fuel. The recent peat production on the whole has been quite satisfactory. At the Elektroperedatch station, by the mechanical compression method, about 7,500,000 poods of peat were produced, and with the hydropeat process there was a total of 12,000,000 poods. An agreement has been made with the Petroleum Syndicate for the required supply of petroleum to the Moscow town station; thus the normal supply of Moscow in the new working year will be completely assured.

Foreign Electrical Business.

MM. B. Ya. Boryakoff and X. Vladen, who went to Constantinople for the Elektrotrust of Central Russia, have returned to Karkoff, and have reported after tests that Russian electrical machinery, in point of quality, is as good as the foreign product, and is also cheaper than, for example, German machines by from 10 to 20 per cent. They report that whilst they were in Constantinople they sold as many as 120 electrical machines of from 1 to 75 h.p. to the Franco-Belgian firm which supplies electricity in Constantinople. The sale was effected by means of an exchange of machines for turbo-generators.

The Russian electrical industry at present has further grounds for success in the principles of the Soviet Government in foreign trading which do not threaten the Turkish economic system. The Turkish electrical market is still very exiguous, and is based at the moment only on a demand for the electrification of Constantinople. Its extension is due to foreign firms which are operating in Turkey in building new power stations and exploiting them on a concession basis, which brings little profit to the Turkish people. But the Russian electrical industry which aims at organising the sale of its products in Turkey and constructing electrical installations does not seek to exploit them, leaving this to be done by the Turks themselves. Forthcoming works that may be carried out in Turkey, the electrification of Angora, Broussa, and Smyrna should interest Russian firms.

During their stay in Constantinople they also linked up relations with Greek and Palestinian firms which could buy electrical goods and equipment.

Electricity in Yaroslaff.

Until the year 1917, there were only three towns in the Government of Yaroslaff provided with electricity stations—Yaroslavl, Rybinsk and Rostoff. There was no electricity in the villages. Now power stations are running in all the towns of the Government, excepting Uglitch, where a station is being completed. The "paying" revenue comes from industries, notably the starch and molasses factories that abound in the Government. The North Molasses Trust, which controls many starch, &c., factories, distributes current for lighting neighbouring villages, and accepts potatoes in payment. The Celchoz or Agricultural Control does the same at very low rates.

Lamp Production.

The Petrograd glow lamp works "Svetlana" is reported to have been considerably extended in the past two years, particularly since it had placed at its disposition a glass factory which supplies the products for the lamps, and the number of persons employed at the works has risen from 300 in 1913, to 1,200 at the present time. The daily production is stated to be about 20,000 lamps, and will be largely augmented in the near future. As difficulties are experienced in procuring wolfram from abroad, the managers are endeavouring to render the works independent of foreign supplies by producing such filaments at the works. The output of gasfilled lamps has hitherto only been carried out on a limited scale, and the present rate of 300 lamps per day is expected to be increased to 3,500 daily in the future. It is asserted that the cost of producing the ordinary glow lamps is less than the price at which lamps can be imported from other countries.

The Energy Section of the State Planning Commission has confirmed a decision of a sub-committee to prohibit the importation, during the year ending September 30th, 1924, of ordinary incandescent lamps, in view of the stocks already existing in the country, and the expected increased production of the Russian lamp factories as from next March, to an extent which will satisfy the needs of the country. An exception, however, is made with regard to gasfilled lamps.

Ukraine Electrical Activity.

The growth of the Ukraine electrical factories' business can be judged from the following figures. The sales of the Karkoff Electrotrust in the third quarter of the economic year just closed, amounted to 575,000 gold roubles value, against 208,000 roubles in the first quarter. The corresponding figures for the Kieff branch were 75,000 g.r., against 40,000 g.r.; and for the Odessa branch, 30,000 g.r., against 10,000 g.r.

Central Russian Electric Trust.

The Central Russian Electric Trust aims at producing goods to the value of 21,137,850 pre-war roubles in the current working year, against 12,914,312 roubles' worth in the working year just closed. The machinery constructional works are intended to be particularly busy. With the reinforcement of the Elochovsky lamp factory, and its extended equipment, the output of lamps is expected to approach three times that of the past year. The number of extra hands to be engaged is estimated at 550.

British Trade with Russia.

The Times correspondent at Riga reports that the Ukrainian Commissariat for Foreign Trade has signed an agreement with a group of British firms for the delivery of great quantities of electro-technical equipment. Details of the agreement, as well as the names of the firms, are not available, but the Soviet Government states that the firms are granting the Ukrainian Commissariat seven years' credit.

Reports have been current for the last few weeks that the representatives of the British Becos who visited Moscow last August are negotiating with the Soviet Government for considerable extensions of credit for goods against long leases of parts of the ports of Petrograd and Odessa.

ELECTRICAL OPPORTUNITIES IN NORTHERN AFRICA.

THE Canadian Trade Commissioner at Milan (Mr. W. McL. Clarke) has recently returned from a mission to Northern Africa where he had interviews in the respective countries of that region with the officials in charge of public works. He found that a very great interest was being taken in the development of the available water-power of Northern Africa more especially for irrigation purposes.

Hydro-Electric Schemes.

Among the most ambitious schemes now under consideration are the arrangements being made to utilise the water of the Shelif River in Algeria, some 700 km. in length, for irrigation purposes and water power.

The first stage, already blue-printed and for which 20 million francs was earmarked in the 1920 budget, will, when completed, furnish a reservoir of some 300 million cubic metres of water, and provide about 40 million kWh of electrical energy per annum. Naturally, the execution of such a project will call for considerable electrical machinery. In Morocco, electrical engineers are also hard at work laying out plans for hydraulic developments. A project is now afoot in the French zone to build several power plants of from 15,000 to 20,000-kW capacity. The plans, as formulated, include a hydroelectric installation at Sidi-Machou, a steam power plant at Casablanca, and a series of developments in the upper basin of the Oum-Er-Rbia river. The controlling idea is to link up these stations with some of the phosphate mines by means of high-pressure transmission lines. The plant at Casablanca which, the Trade Commissioner was informed, will probably be completed early next year, is to have three 6,000-kW turbo-alternators. A 5,000-kW unit is also to be installed on the river previously mentioned. Other Moroccan schemes, not yet, however, in operation, are proposed with regard to the River Sebou, while the falls in the streams flowing through the town of Fez are to be more largely used. The waterfalls in the Atlas Mountains are also in the future to be tapped. It is estimated, though perhaps too optimistically, that the rivers of Morocco could eventually supply about three million h.p. of electrical power, half of which could be produced by the Oum-Er-Rbia River alone. Even if such an estimate is on a too grandiose scale, the fact remains that the future expansion of Morocco will in all probability involve considerable expenditure on electrical equipment.

Tunisia, the smallest of the three countries, is capable of developing, it is estimated, about 20,000 h.p., and as yet very little of this available hydro-electric power is utilised. A few barrages have been built for irrigation purposes, and many more are likely to be constructed in the next few years. Accordingly throughout the whole of Northern Africa attention is being directed to, and private capital is being sought for, the practical exploitation of the water-power resources of the country.

Telegraph and Telephone Extensions.

Mr. Clarke states that the telephone and telegraph systems of Northern Africa are being improved from time to time. Interurban telephone systems exist between the principal centres of each of the countries, as well as in the cities themselves, while a network of telegraphs reaches nearly all the important and strategic parts. The length of telephone lines in North Africa may be placed at almost 50,000 miles, and there are probably nearly 15,000 subscribers. Not only is the material now being used constantly in need of replacement, but with the further opening-up of the country and with the assimilation of Western ideas by still more of the population, the opportunity for selling telephone equipment will undoubtedly increase. This is especially true in Morocco. Both 3 mm. and 2½ mm. copper wire are in demand.

The Trade Commissioner says that tramways will probably be introduced into Casablanca, and extensions made in Algiers. They already exist in Turin and Oran, and are likely to be wanted in Rabat.

Tunis, Algiers, Oran, Casablanca and Tangiers, all have electric street lighting, as well as a few other of the smaller towns. Electric light is extremely popular with the Moors, and most of those who are well-to-do have installed it in their houses where it is publicly available. When it is not obtainable from a central supply, private installations have in some instances been purchased. Mr. Clarke adds that it is generally thought that the use of electricity will eventually extend over the whole of Algeria, Tunisia, and Morocco, and be utilised in even the small native villages.

Lighting Fittings Required.

The lampholders in use are nearly all of the bayonet catch type, not only in Morocco but elsewhere in North Africa. Wall switches and sockets are usually made in porcelain, and the snap turning handle is most common. Pull-chain and push-button switches are practically unknown. Cut-outs often consist of a porcelain base with a light metal cover lined with cardboard. Cluster sockets are not common, but are found in the larger cities of Tunisia and Algeria. In general, however, an ordinary drop-cord light is used. Shades are often of cardboard and tin, or otherwise generally of the opaque glass type, although in the cities of Algiers, Oran, and Tunis many houses and shops are fitted up with quite high-class electroliers. Conduit work is found only in the more important centres, and there electric conduit with sleeves, junction boxes, and mountings is required. For ordinary distribution work porcelain insulators are employed. The 16-c.p., metallic-filament lamps meet with the biggest demand, although sizes up to 100 c.p. are frequently used. Secondary pressures running from 110 to 250 V are found throughout North Africa for lighting purposes, and both direct and alternating current, three-phase, are commonly generated. Insulated wire of 300 and 600 megohm grade is most often used. The dry-cell battery has now the greatest part of the electrical trade, although the jar battery is occasionally used, especially in connection with electric bells.

The sale of household electrical specialities is extremely limited at present, but on the other hand, table and wall fans enjoy a fairly good sale.

THE NEW REGULATIONS FOR OVERHEAD LINES.

The following are the regulations for overhead lines prescribed by the Electricity Commissioners and issued last week*; they are here reprinted by permission of the Controller of H.M. Stationery Office :—

Definition.

In the following regulations :—

The expression "line conductors" means conductors used for transmitting a supply of electrical energy, including so much of any service line as may be under the control of the undertakers.

I.—General.

1.—*Material of Line Conductors.*—Line conductors shall be of copper, aluminium, or such other materials as may be approved by the Electricity Commissioners.

2.—*Strength of Line Conductors.*—All line conductors at the time of erection shall comply, as regards elongation, breaking load and elasticity, with the specification of the British Engineering Standards Association then in force.

Provided that if at that time no such specification shall be in force the characteristics of the material as measured on a single wire shall not be less than the following :—

Material.	Elongation in length of 10 in.	Breaking load.	Young's Modulus of Elasticity.
	Per cent.	Tons per sq. in.	Lb. per sq. in.
Copper	1	24	18×10^6
Aluminium	4	11	10×10^6

3.—*Minimum Size of Line Conductor.*—The minimum permissible sizes for copper and aluminium line conductors shall be such as to have an actual breaking load of not less than 650 lb., the equivalent minimum cross-sectional areas and weights per mile being as follows :—

Material.	Cross-sectional area.	Weight per Mile.
	sq. in.	Lb.
Copper	0.0098	200
Aluminium	0.0237	147

4.—*Line Conductors to be inaccessible.*—Line conductors shall be rendered inaccessible to any person from any building or other place without the use of a ladder or other special appliance.

Regard shall be had to the normal use by the occupier of any premises or land and where necessary (*a*) the height of the line conductors shall be increased to provide sufficient clearance for safety in accordance with such use, and (*b*) provision as hereinafter prescribed in Regulation 17 shall be made to prevent danger.

5.—*Line Conductors Crossing other Lines.*—Where a line conductor crosses over or under, or is in proximity to any other overhead wire, precautions shall be taken by the Undertakers to prevent contact, due to breakage or otherwise, between the line conductor and the other overhead wire, or between the other wire and the line conductor.

Provided that this Regulation shall not be deemed to require the Undertakers to take precautions against contact between a broken line conductor and other auxiliary conductors and earth wires carried on the same support and forming part of the same overhead line.

6.—*Supports.*—Line conductors shall be attached to suitable insulators carried on supports of wood, iron, steel or reinforced concrete. All wooden supports other than oak or hard wood cross-arms shall be of red fir impregnated with creosote. Special precautions shall be taken to prevent the corrosion of all metal work at or below the surface of the ground.

7.—*Factor of Safety of Supports.*—The supports, in conjunction with stays or struts if provided, shall withstand the longitudinal, transverse and vertical loads which occur without damage and without movement in the ground. In no case shall the strength of a support in the direction of the overhead line be less than *one-quarter* the required strength in a direction transverse to the line.

The following factors of safety shall apply to each support :—

Material.	Factor of safety.
Iron or steel	2.5
Wood	3.5
Reinforced concrete	3.5

These factors of safety shall be calculated on the assumption that all line conductors, cables and wires carried by the supports are at a temperature of 22 deg. F., and have a covering of ice to the radial thickness specified in Regulation 11 (or Regulation 14 according to the voltage) and that together with the supports they are subjected to a wind of 50 miles per hour at right angles to the line, this wind to be taken as exerting a pressure equivalent to 8 lb. per square foot calculated on the whole of the projected area.

Under similar conditions of loading, the strength of the foundations shall be such as to give for all types of support a factor of safety of 2.5 against overturning.

In the case of lattice steel or other compound structures, including A and H poles, the wind pressure on the lee side members shall be taken as one-half of the wind pressure on the windward side members and the factor of safety shall be calculated on the crippling load of struts and upon the elastic limit of tension members.

8.—*Service Lines.*—Service lines shall be connected to line conductors at a point of support only and shall be fixed to insulators on consumers' premises. Every part of a service line (other than a neutral conductor connected with earth) which is accessible from a building with the use of a ladder or other special appliance shall be efficiently protected either by insulating material or by other means approved by the Electricity Commissioners.

Where a service line is carried along or across a carriageway, the height of the line from the ground at any part of the carriage-way shall not, except with the consent of the Electricity Commissioners, be less than 20 ft.

9.—*Inspection and Maintenance of Lines.*—Every overhead line, including its supports and structural parts, and electrical appliances and devices belonging to or connected therewith, shall be regularly inspected and efficiently maintained.

10.—*Materials used.*—All materials used shall at the time of erection conform to the specifications of the British Engineering Standards Association, and to the Post Office Technical Instructions for the Construction of Aerial Lines for the time being in force, so far as the same are applicable and are not inconsistent with these regulations.

II.—Specific Regulations.

[*Applicable according to the voltage between line conductors where no part of the system is connected with earth, or according to the voltage to earth where part of the system is connected with earth.*]

A.—For pressures not exceeding 650 volts direct current and 325 volts alternating current.

11.—*Factor of Safety of Line Conductors.*—The factor of safety of line conductors shall be 2. The factor of safety shall be based on the breaking load and shall be calculated on the assumption that the line conductors are at a temperature of 22 deg. F., and have a covering of ice to a radial thickness of one-quarter of an inch, and that they are simultaneously subjected to a wind of 50 miles per hour at right angles to the line, this wind to be taken as exerting a pressure equivalent to 8 lb. per square foot calculated on the whole of the projected area of the ice-covered lines.

The weight of the ice is to be taken as 57 lb. per cubic foot.

The elasticity of the metal stated in Regulation 2 may be allowed for in calculating the sag for line conductors.

12.—*Minimum Height of Conductors.*—The height from the ground of any line conductor (other than a service line), earth wire, or auxiliary conductor at any point of the span at all temperatures below 122 deg. F. shall not, except with the consent of the Electricity Commissioners, be less than 20 ft.

13.—*Provision to Prevent Danger.*—Where the pressure to earth exceeds 250 volts direct current, or 125 volts alternating current, precautions shall be taken to prevent danger—

(1) from a broken line conductor by the provision of
  (*a*) one or two continuous neutral or other earthed wires carried from pole to pole and so arranged with relation to the other wires that, in the event of breakage, the line conductor must make contact with the earthed wires or metal work connected thereto; or
  (*b*) other means approved by the Electricity Commissioners.

(2) from leakage by the provision
  (*a*) in cases where metal poles are used, of
    (i) an earthed wire, running from pole to pole and connected to the poles; or
    (ii) a suitable metal framework to support the insulators carrying the line conductors, the framework being insulated from the pole but connected to the neutral conductor; or
    (iii) other means approved by the Electricity Commissioners.
  (*b*) in cases where wooden poles are used, of
    (i) a bonding wire connected to the supporting metalwork of all insulators, the bonding wire terminating at the lowest part of the supporting metalwork and being at a height of not less than 10 ft. from the ground; or
    (ii) other means approved by the Electricity Commissioners.

Where lightning conductors are used or other uninsulated conductors are run down wooden poles to within 10 ft. from the ground, the precautions for the prevention of danger from leakage shall be as for metal poles.

All stay wires other than those which are connected with earth by means of a continuous earth wire shall be insulated to prevent danger from leakage. For this purpose an insulator shall be placed in each stay wire at a height of not less than 10 ft. from the ground.

B.—For pressures exceeding 650 volts direct current and 325 volts alternating current.

14.—*Factor of Safety of Line Conductors.*—The factor of

* El. C.39. H.M. Stationery Office, price 2d. net.

safety of line conductors shall be 2. The factor of safety shall be based on the breaking load and shall be calculated on the assumption that the line conductors are at a temperature of 23 deg. F., and have a covering of ice to a radial thickness of half an inch, and that they are simultaneously subjected to a wind of 50 miles per hour at right angles to the line, this wind to be taken as exerting a pressure equivalent to 8 lb. per square foot calculated on the whole of the projected area of the ice-covered lines.

The weight of ice is to be taken as 57 lb. per cubic foot.

The elasticity of the metal stated in Regulation 2 may be allowed for in calculating the sag for line conductors.

15.—*Minimum Height of Conductors.*—The height from the ground of any line conductor at any point on the span at all temperatures below 122 deg. F. shall not, except with the consent of the Electricity Commissioners, be less than the height hereunder stated:—

Pressures not exceeding 66,000 volts.	20 feet.
Pressures exceeding 66,000 volts and not exceeding 110,000 volts.	21 feet.
Pressures exceeding 110,000 volts and not exceeding 165,000 volts.	22 feet.
Pressures exceeding 165,000 volts.	23 feet.

16.—*Provision to Prevent Danger.*—Adequate means shall be provided to render any line conductor dead in the event of its falling due to breakage or otherwise.

All metal work other than conductors shall be permanently and efficiently connected with earth. For this purpose a continuous earth wire shall be provided and connected with earth at four points in every mile, the spacing between the points being as nearly equidistant as possible, or, alternatively, the metal work shall be connected to an effective earthing device at each individual support. The design and construction of the system of earth connections shall be such that when contact is made between a line conductor and metal connected with earth the resulting leakage current shall not be less than twice the leakage current required to operate the devices which make the line dead.

17.—*Road Crossings, &c.*—Where an overhead line is erected along or across a public road on canal or across a railway, all wires including earth and auxiliary conductors shall be placed at the appropriate height from the ground specified in Regulation 15, and the following additional precautions shall be taken to prevent danger:

(1) In the case of a line erected along a public road or canal (or within 50 ft. thereof) there shall be provided—

(*a*) duplicate insulators supporting the conductors; or

(*b*) a device to ensure that in the event of a line conductor falling it shall be put to earth; or

(*c*) other means approved by the Electricity Commissioners.

(2) In the case of a line erected across a public road, canal or railway there shall be provided—

(*a*) duplicate insulators for supporting the line conductor and a device to ensure that in the event of a line conductor falling it shall be put to earth; or

(*b*) duplicate insulators supporting duplicate conductors tied at intervals not exceeding five feet; or

(*c*) other means approved by the Electricity Commissioners.

18.—*Danger Notices.*—Supports shall be numbered consecutively and each support shall have a danger notice of a permanent character securely fixed to it. Adequate provision shall also be made to prevent unauthorised climbing.

ON THUNDERBOLTS.

By W. M. THORNTON, D.Sc., D.Eng.

(*Abstract of paper published in the* PHILOSOPHICAL MAGAZINE, *May*, 1911.)

THE term thunderbolt is given in common use both to the rare phenomenon of ball lightning and to meteoric stones. It is here used to describe the former. The singularity of ball lightning lies in the complete isolation of a gaseous sphere having no envelope, yet within which there is energy stored by previous electrical action. This is in the end liberated with explosive violence.

From the scattered records of its appearance the following facts may be regarded as established. It is observed as a luminous blue ball, occurring after lightning flashes of great intensity, and either falling slowly from clouds or moving horizontally some feet above the earth's surface. It is seen more often at sea than on land, and both vertical and horizontal movements are recorded in each case. Ball lightning appears to move under gravitative action on a mass somewhat denser than air, or horizontally in a feeble air-current or electric field of force. It has been observed to follow the course of a conductor such as a water-main, and in most cases to burst on reaching water. It has also been seen to burst in mid-air. That it has some elastic cohesion is shown by its spherical shape and by its rebounding from the earth—in one case at least—after falling vertically. The features of its end are significant; the ball simply ceases to be and an explosion wave travels outwards from the spot. In all cases its disappearance is followed by a strong smell of ozone.

There are records of its curious selective behaviour in the neighbourhood of conductors. Thus a fireball came down a chimney, approached a person in the room (who slowly avoided it), retired up an old flue papered over, breaking through the paper, and finally burst with great violence on reaching the chimney-top, doing considerable damage. It may be inferred from this that its undoubted immense energy is not in the form of any surface charge which would have had many opportunities of dissipation in such a journey.

From the circumstances of its origin it is clear that there can be nothing present in it but the gases of the atmosphere. That their molecular condition is abnormal is shown by the light which permeates the whole, and the only possible inference from this is that there is atomic rearrangement proceeding actively within the mass. This blue colour is characteristic of a state of air in which there is proceeding intense electric dissociation, as, for example, in the immediate neighbourhood of a highly-charged needle-point. The chief product of molecular change under electric stress in air is ozone. This is shown by the fact that at a charged point ozone is given off freely at the negative, and to a much less extent at the positive pole. Nitric oxide is not produced in this case, and it appears to be necessary to have streams of sparks to give rise to the formation of nitrogen compounds in air. A stream of ozone produced electrically in a Siemens tube from oxygen carries a negative charge.

This suggests an explanation of the origin of the energy in ball lightning. On the occurrence of a flash of lightning from a charged cloud there is an immediate readjustment of the surface electrical conditions, and in certain cases there is the so-called return flash, closely following the first, caused by such a readjustment of the distribution of charge on cloud and earth. If at any projecting part of a negatively-charged cloud the stress is nearly but not quite sufficient for a second flash, there will be for a time ionisation on a great scale with the formation of ozone which, when sufficiently local in production, gathers into a ball, is repelled and falls. The volume produced depends on the energy immediately available. The process is of the same nature as the point discharge; but whereas under the stress possible in a laboratory the space in which the glow occurs has a radius of about half a millimetre, under the colossal stress in thunder-clouds it may quite well occur simultaneously in a space a yard in diameter, that of the largest fireball known. At the mast-heads and yards of ships at sea in tropical thunderstorms a blue light is frequently seen—St. Elmo's fire—a foot or more in radius.

All records agree that a thunderbolt is somewhat heavier than air. Nitrogen is lighter than air, and no allotropic form of it is known, though oxides of nitrogen are produced under the influence of streams of electric sparks. Oxygen is slightly heavier than air, ozone is nearly 70 per cent. heavier. The gravitating force on a sphere of ozone a metre diameter in air is 430 grammes—nearly a pound weight. Such a sphere would descend at a rate quick enough to be called a fall. On one of half this size the force would be 54 grammes. For such quantities not to fall but to travel horizontally there must be electrostatic repulsion from the earth requiring, since ozone carries a negative charge, a similar charge on its surface, which is known to generally exist. It is improbable that the cloud and earth below it should both be negatively charged at the same instant. It would be the normal thing for the ball to approach the earth with considerable velocity, as is recorded in well authenticated cases. The fact that sometimes it turns off parallel to the earth's surface indicates that if, at the moment of the last discharge, the earth was locally positive, its sign has changed by reason of the electrical discharge, and is as usual negative.

The reason why the gas gathers into a sphere is that since

the energy of ozone is for a given mass greater than that of oxygen, whilst the volume is less, the force between molecules of oxygen and ozone is an attraction, which decreases in the aggregate as recombination proceeds, until it has the same value as the repulsion due to the usual molecular bombardment in gases. The temperature rising on account of the heat set free, equilibrium would be quickly reached, the cooling of the ball by radiation and its motion through the air giving it stability. On reaching water, for which ozone has a strong affinity, or anything which causes ozone to decompose with great rapidity, the ball explodes.

The most conclusive evidence for any suggested constituent is whether this contains energy in such a form that it can be quickly liberated. It is well known that ozone reverts to oxygen, and it remains to see whether the energy liberated by this change is sufficient to account for the effects observed on its sudden occurrence.

In the conversion of a gramme of oxygen into ozone 29.6 kilogramme-degree-Centigrade units of heat are absorbed. A sphere of 50 cm. diameter contains 62.5 litres. For the complete change of oxygen at 1.45 grammes per litre to this volume of ozone at 2.14 grammes per litre there would be required 2,615 of the above heat units. A clearer view of what this means is obtained by expressing it in mechanical units. Each kilogramme-degree unit is equivalent to 3,094 foot-pounds; the total energy of transition is therefore 8,000,000 foot-pounds.

It is unlikely, since there is recombination proceeding by diffusion within the ball as it falls, that the whole mass could be pure ozone on reaching the earth, but the dissipation of one-tenth of the above energy explosively in the tenth of a second is at the rate of 15,000 h.p.

The energy of the explosion-wave is well accounted for by this. There is in addition the sudden expansion when ozone is changed into oxygen, in this case 20 litres for a sphere of 50 cm. diameter of ozone.

The blue colour usually observed is associated with the sparkless electrical discharge in air which causes the production of ozone. It is also observed when oxygen and hydrogen combine explosively; when nitrogen is present the colour of the explosion flame is yellow.

These considerations lead one to suggest that the principal, though not perhaps the only constituent, of thunderbolts is an aggregation of ozone and partially dissociated oxygen, thrown off from a negatively-charged cloud by an electric surge after a heavy lightning discharge.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS AND MACHINERY IN OCTOBER, 1923.

The month's return of electrical export business shows an increase of £210,299, as compared with September, and an increase of £169,278 on the figures for October, 1922. As compared with last month's totals it will be seen that all items of electrical exports, with the exception of submarine cables and switchboards, show considerably enhanced values, this being especially marked in the sections for electrical machinery, insulated wires and cables, and telegraph and telephone cable and material. In comparison with October, 1922, the only falls are in the batteries and accumulators, switchboards and submarine cable sections. All the other sections record considerable increases, especially those for electrical goods and apparatus, insulated wires and cables, electrical machinery, and telegraph and telephone cables and apparatus.

The electrical exports for the first ten months of 1922 and 1923 were :—

Exports.	1922	1923
Electrical goods and apparatus...	£6,084,565	£6,872,491
Electrical machinery	3,528,365	3,122,350
Totals for 10 months	£9,612,930	£9,994,841

Electrical goods and apparatus show an increase for the ten months of £787,926, while electrical machinery exports are £406,015 less than for the same period in 1922.

The electrical import figures for the month are £331,422, an increase of £13,256 on the previous month and £114,330 in excess of the totals of October last year, the principal increases as compared with last month occurring in the items for glow lamps (£13,800) and telegraph and telephone cable and material (£28,500), whilst a decrease of £25,947 is shown in the electrical machinery section. As compared with October, 1922, the sections for electrical goods and apparatus, glow lamps, electrical machinery, and telegraph and telephone cable and material each record greatly increased values, the advance aggregating £114,330.

The electrical import figures for the first ten months of 1922 and 1923 were :—

Imports.	1922	1923
Electrical goods and apparatus...	£1,171,017	£1,896,521
Electrical machinery	1,027,758	854,738
Totals for 10 months	£2,198,775	£2,751,259

The re-exports of Colonial and foreign electrical goods and electrical machinery for October totalled £17,269, an increase of £1,058 as compared with September and £6,097 in advance of the October, 1922, figures.

The re-export figures for the first 10 months of 1922 and 1923 were :—

Re-exports.	1922.	1923.
Electrical goods and apparatus ...	£137,810	£84,239
Electrical machinery	39,371	86,506
Totals for 10 months	£177,181	£170,745

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Oct. 1923.	Inc. or dec. as compared with Sept., 1923.	Inc. or dec. as compared with Oct., 1922.	Electrical imports for Oct., 1923.	Inc. or dec. as compared with Sept., 1923.	Inc. or dec. as compared with Oct., 1922.	Electrical re-exports for Oct., 1923.	Inc. or dec. as compared with Sept., 1923.	Inc. or dec. as compared with Oct., 1922.
Electrical goods and apparatus (unenumerated)	£178,296	+ £15,123	+ £49,450	£81,156	— £3,147	+ £23,996	£4,701	+ £1,134	+ £1,637
Insulated wires and cables ...	216,948	+ 38,449	+ 49,234	34,387	— 846	+ 1,207	151	— 18	+ 53
Glow lamps	40,112	+ 4,854	+ 9,769	31,773	+ 13,861	+ 11,162	694	— 133	— 106
Arc lamps and parts	1,133	+ 877	+ 958	866	+ 37	— 123	248	— 14	— 191
Batteries and accumulators ...	49,392	+ 3,367	— 19,140	16,900	— 1,092	— 2,858	1,048	+ 598	+ 1,048
Meters and instruments ...	36,453	+ 7,949	+ 5,740	7,216	+ 523	+ 1,756	380	— 307	— 745
Carbons	11,895	+ 7,802	+ 3,652	10,095	+ 1,319	+ 3,795	30	— 23	— 297
Electrical Machinery—									
Electrical machinery (unenumerated)	166,232	+ 28,617	+ 16,847	75,009	— 25,947	+ 30,471	7,021	+ 174	+ 3,066
Railway and tramway motors	35,141	+ 4,286	+ 11,052	—	—	—	—	—	—
Other motors and generators ...	143,161	+ 26,565	+ 10,579	—	—	—	—	—	—
Switchboards (not telegraph or telephone)...	7,683	— 1,556	— 2,784	—	—	— 121	—	— 48	
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	101,011	+ 37,649	+ 27,612	7,716	+ 4,293	+ 5,618	172	— 850	+ 172
Submarine telegraph and telephone cable	14,473	— 31,750	— 21,994	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	175,629	+ 68,072	+ 28,303	66,304	+ 34,237	+ 39,127	2,824	+ 545	+ 1,540
Totals	£1,177,559	+ £210,299	+ £169,278	£331,422	+ £13,256	+ £114,330	£17,269	+ £1,058	+ £6,077

Increase or decrease for the ten months ended October, 1923.	Exports.	Imports.	Re-exports.
	+ £381,911.	+ £552,484.	— £6,436.

BINARY-FLUID TURBINES.

The Possibilities of the Mercury-Water Machine.

AFTER briefly discussing methods of improving the efficiency of large steam turbines in a paper he recently read before the Institution of Mechanical Engineers, Mr. W. J. Keaton (Walker Engineering Laboratories, University of Liverpool) summarised the present position of the single-fluid steam turbine as follows:—

If a total temperature of 750 deg. F. be assumed, the efficiency of the ideal turbine operating between pressure limits of 600 and 0.5 lb. per sq. in. absolute would be 38.2 per cent. Assuming a turbine efficiency of 80 per cent., a generator efficiency of 95 per cent., and a boiler efficiency of 80 per cent., the overall thermal efficiency of the plant would be 23.2 per cent. By utilising low-temperature turbine steam for feed-heating purposes, this figure would become about 24.4 per cent. Thermal efficiencies much higher than this can hardly be expected. The fundamental difficulty with steam is the fact that at what may, in future, be regarded as moderate temperatures, the vapour pressure is too high.

As no ideal fluid is in existence the binary principle (which was proposed about 1850 by Du Tremblay) must be resorted to and the author outlines its possibilities with mercury and water as the working substances.

A complete "mercury-vapour steam" turbine plant is shown in fig. 1. Mercury vapour is generated in the mercury boiler at a high temperature and a moderate pressure, and may be superheated or delivered direct to the turbine in a more or less dry condition. Owing to the great density of the liquid, drying the wet vapour should be a relatively easy matter. After expansion in the turbine the vapour enters the condenser, in which the latent heat of the mercury vapour generates steam, which collects in A. The liquid mercury is then pumped out by B and passed through the mercury economiser into the boiler. The total weight of mercury in the system must be a minimum. This depends upon the volumetric capacity of the economiser and boiler and the rapidity of circulation. Trouble due to incrustation would hardly be anticipated, and there seems to be no reason why the major portion of the heating surface should not be provided by a large number of tubes of small diameter. Mercury vapour leakage must be entirely eliminated. In the first experimental

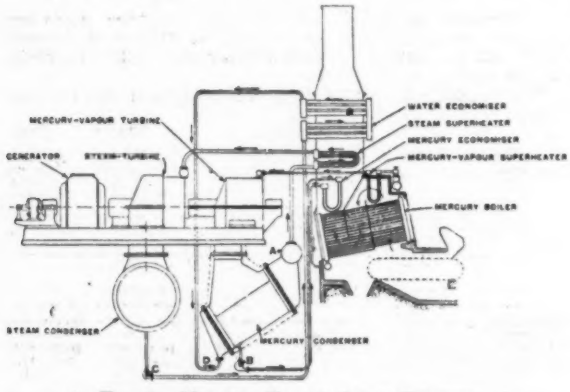


FIG. 1.—MERCURY-VAPOUR STEAM TURBINE.

turbine constructed in America the boiler pipe connections were welded, but this has undesirable features; for certain joints which might require to be broken now and again the pipe-joint shown in fig. 2 is suggested. Ends B are welded to the pipes A; a double-diamond-section ring C of nickel is nipped between the flanges B and embeds itself into the flanges. Each flange is provided with a spherical seat and a loose ring D, which must be slipped on to the pipe before welding. With this arrangement, however unequally the bolts may be tightened up, the pressure between the flanges and the ring C would be equally distributed all round. A connection between the space E and the condenser would be made by the pipe F so that any vapour leaking past the first ring would flow into the condenser. The prevention of leakage at the turbine glands could be overcome by a suitable labyrinth and impeller type of gland.

In describing the steam-cycle a start may be made at the extraction pump C, which, in conjunction with the feed pump, delivers the feed water into the economiser, where a certain amount of sensible heat is taken up by the water. From thence it enters the mercury condenser at D, passes through an inclined bank of tubes, in which it is evaporated, and collects in A. It then passes successively through the superheater, turbine, and condenser in the usual manner.

A brief review of the various properties of mercury follows and determinations are tabulated. Having discussed the various sources of data it is pointed out that the calculation of the properties was first made on a temperature basis, the vapour pressure being calculated for every 10 deg. F. from 32 deg. F. to 1,000 deg. F. The specific heat of the liquid was next calculated at frequent intervals of temperature and set down on a series of graphs. The sensible heat of the liquid was then calculated by a "step by step" process for every 10 deg. F. and integrated arithmetically. The latent heat was calculated directly for every 10 deg. F. and the changes of

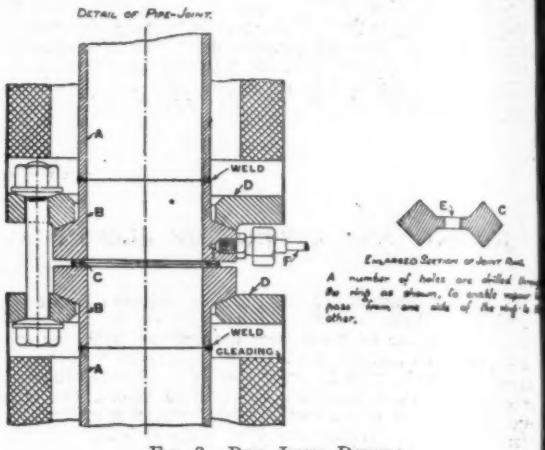


FIG. 2.—PIPE JOINT DETAILS.

entropy during the addition of sensible heat were calculated for 10 deg. F. intervals and also integrated arithmetically, whilst the change of entropy during vaporisation was calculated at every step. The whole of these properties were then laid on the above-mentioned series of graphs and pressure tables compiled directly from the graphs. The more useful portion of the total-heat entropy diagram is reproduced in fig. 3.

In order to calculate the throat area of nozzles required to pass a given mass of mercury vapour the critical pressure ratio has been calculated. It is about the same as those for

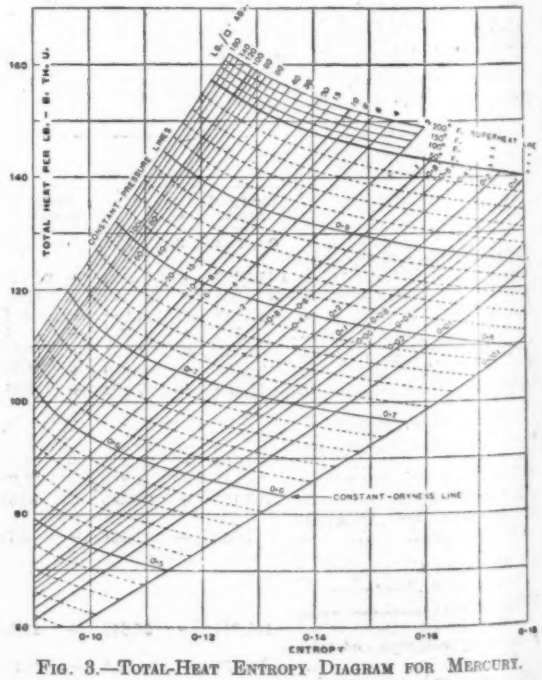


FIG. 3.—TOTAL-HEAT ENTROPY DIAGRAM FOR MERCURY.

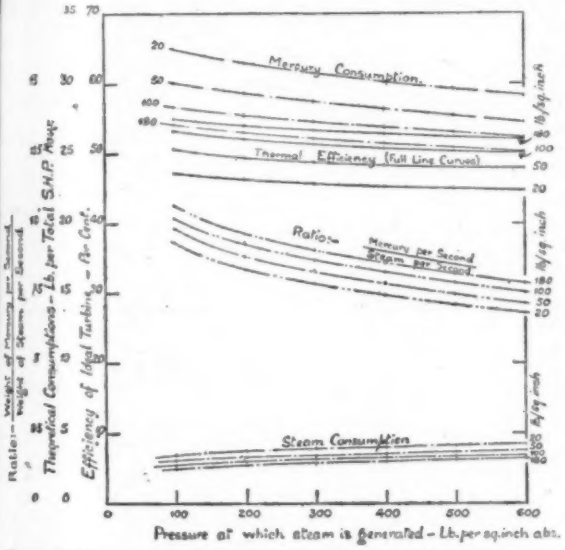
steam, which are 0.577 and 0.5457 for dry saturated and for superheated steam respectively. Whilst the critical heat drop for steam is about 45 B.th.u. and the critical velocity about 1,500 ft. per second, those for mercury vapour are only about 7.6 B.th.u. and 610 ft. per second respectively. If it be assumed that the blade velocity in the mercury-vapour turbine

would be similar to that in a steam turbine (about 500 ft. per second) the velocity of the mercury vapour at exit would require to be in the neighbourhood of 1,200 ft. per second. The mechanical construction of the mercury-vapour impulse turbine is thus unavoidably complicated by the use of convergent-divergent nozzles, although this disadvantage may be more than outweighed by the smaller number of stages required.

Although the velocity of mercury vapour is less than that of steam for the same back pressure, the specific volume is less still, with the result that the mass discharge of mercury vapour is two and a-half times that of steam per unit area of nozzle throat. In the mercury-vapour turbine the area which is important is the exit area. In this respect, whether the mercury nozzle or the steam nozzle will discharge the greater mass in a given time depends upon the exit velocity required. A relatively low exit velocity, which would also probably give a more favourable value of the ratio of blade-speed to jet-speed, would seem to be preferred for mercury in cases where the question of exit area is vital. This may be regarded as a general principle which does not arise in steam-turbine practice.

The theoretical thermal efficiency of the binary-fluid turbine with steam and mercury vapour as the working substances may be obtained by reference to the Mollier chart and tables of properties. This has been done for four initial pressures of dry saturated mercury vapour, a final pressure of 0.5 lb. per sq. in. abs. in the steam-turbine exhaust branch, a hot-well temperature of 80 deg. F., and for steam pressures varying from 64 lb. per sq. in. abs. to 600 lb. abs.

The results are illustrated graphically in fig. 4, all curves being drawn on a base of steam pressures. The thermal


Mercury Consumption.
Thermal Efficiency (Full Line Curves)
Ratios
Steam Consumption
Pressure at which steam is generated - Lb. per sq. inch abs.

Figures adjoining curves indicate initial absolute pressure of dry saturated mercury.

Fig. 4.—Thermal Efficiency and Consumption of Binary-Fluid Turbine.

efficiency is higher, the higher the initial temperature of the mercury vapour. With a temperature of 1,000 deg. F. and a steam pressure of 100 lb. per sq. in., the theoretical efficiency is no less than 55 per cent. If it be assumed that an initial temperature of 812 deg. F. is practically possible, the corresponding figure is 50.5 per cent. Assuming, for the purpose of comparison with the steam plant, a boiler efficiency of 80 per cent., a turbine efficiency of 80 per cent., and a generator efficiency of 95 per cent., we have an absolute thermal efficiency of 30.7 per cent., which shows an improvement of 32.3 per cent. on the steam plant considered earlier in the paper (*i.e.*, 24.4 per cent.). The brake thermal efficiency in the above example will be 32.3 per cent., and for the purpose of comparing the binary-fluid turbine with other forms of prime mover Table I has been drawn up.

Although the efficiency of the mercury-vapour steam turbine is still somewhat inferior to that of the Diesel engine and the binary-fluid Still engine, it possesses all the important advantages of the steam turbine; that is to say, it is mechanically ideal, and can be constructed to develop relatively high powers with ease. Coupled to these undoubted advantages its high thermal efficiency will probably make it the foremost prime mover for the generation of electric power on a large scale. It is doubtful if it will ever be adopted for the propulsion of merchant ships, because simplicity and reliability are more important factors than fuel consumption in such a case. On trade routes where fuel oil is comparatively cheap, the Diesel engine will probably hold the first place, but on other routes, where coal is the cheaper fuel, the adoption of the mercury-vapour steam turbine is not beyond the bounds of possibility, but such developments are not likely to take place until the binary-fluid turbine has proved its reliability ashore.

The combined heat drop per 1 lb. of steam per second is roughly twice the corresponding figure for a steam turbine under ordinary conditions; hence, if no difficulties arise in the design of the mercury-vapour turbine, a steam turbine frame of a given size could, under similar steam conditions, be designed for about twice the normal power. This is a feature of great importance. The design of the mercury-vapour turbine under defined conditions will, or will not, present difficulties according as the final pressure of the mercury vapour is below or above a certain figure.

Table I.—Absolute Thermal Efficiencies.

In all cases the efficiencies are based upon the heat in the fuel, and are therefore truly comparable values.

Prime mover.	Efficiency. Per cent.
Four-cycle Diesel engine ...	... 34.2
Two-cycle „ „ ...	... 32-33
Suction-gas engine	... 19-22
Still engine	... 37.7
Steam turbine	... 19-54*
Gas turbine	... 24.7
Mercury-vapour steam turbine	... 32.3

* A boiler efficiency of 80 per cent. has been assumed. The steam conditions in this case are moderate, being: Initial pressure, 209 lb. per sq. in. gauge. Total temp. 500 deg. F., vacuum 28.86 in. Hg. (30 in. Bar.).

On the assumption that the steam is initially dry and saturated, the specific volume at exhaust has been calculated for varying initial pressures and vacua of 27½, 28, 28½ and 29 in., the efficiency of the turbine being taken as 80 per cent. A similar calculation has been made for mercury for initial pressures of 180, 100, 50 and 20 lb. per sq. in. and varying back-pressures; the results in both cases, but particularly in the case of mercury, show that the initial pressure has a very small effect on the final specific volume.

In view of the low heat-drop in the mercury-vapour turbine it is probable that the best results would be obtained by the use of a single-expansion, double-flow turbine, having as large a diameter as feasible. Amongst other advantages this scheme possesses the following:—

(*a*) The chest containing the high-temperature poisonous vapour can be made unicellular, thus eliminating the risk of leakage.

(*b*) The connection between the casing and this chest could be made as thin as possible, so as to diminish the loss of heat to the turbine casing by conduction.

(*c*) The external glands would be subjected to a negative pressure of mercury vapour. Thus leakage to the atmosphere would be entirely eliminated, except, perhaps, when starting up. Such glands could be packed with liquid mercury whirling in a casing and set in motion by an impeller on the shaft.

(*d*) A lower steam pressure can be adopted, which simplifies considerably the design of the mercury condenser and of the steam turbine. At the same time the efficiency is improved.

TELEPHOTOGRAPHY AND TELEVISION WITHOUT WIRES.

A Royal Society of Arts Lecture.

A lecture, with demonstrations, was delivered before the Royal Society of Arts, in London, on November 14th, by M. Edouard Belin, on the transmission of writing, drawings, photographs, &c., without wires. Mr. A. A. Campbell Swinton presided.

M. Belin, who lectured in French, observed that much had been said during the last few years respecting telephotography. For a long time the studies of the inventors had been concerned with experiments in their laboratories and in practical applications. The latter had proved how difficult it was to overcome the obstacles which separated the laboratory from practical application, and that was the reason why the results, so long expected, had only now been achieved successfully. To-day the object appeared to have been attained, and it was opportune not only to make it known, but also not to limit merely to telephotography a result which had a so much wider scope. Besides the transmission, at a distance, of photographs, it also embraced teleautography, which concerned the reproduction of drawings and especially of handwriting by telegraphy.

Lastly, there was television, which must not in any way be looked upon as simply an improvement on telephotography, but constituted a thing quite apart, which was nearly, and would soon be actually, vision at a distance, a problem long considered as chimerical, but to-day looked upon as possible and to-morrow would be one of the realities.

The Belin system of telephotography had to undergo many improvements in order to be not only of practical use, but also to respond to the actual conditions of the telephonic system. The system, which was now sufficiently well known, had led to the realisation of apparatus which was equally

adaptable to teleautography, for the use of which the French postal and telegraph authorities had erected the first stations in Paris, Lyons and Strasburg. Messages thus transmitted were authentic, and even the transmission of shorthand would probably become general.

An alternative of the same system permitted absolute secrecy to be guaranteed in telegraphic and radiotelegraphic transmission.

Autograph messages had been transmitted by telegraphy without wires in France and America, and quite recently M. Belin was able to transmit by "wireless" real photographs in half tones. (That was actually done at the meeting on Wednesday, when a photograph of the Prince of Wales was transmitted successfully from one side of the room to the other.)

For several months, said M. Belin, the researches made in the laboratory at La Malmaison had enabled the realisation in principle of the first experiments showing that television was no longer an impossibility. All the experiments were made with "wireless," and he had come to the conclusion that the expected solution of that problem was very near at hand. Its realisation would creat a new bond between peoples living at a distance, enabling them to learn to know each other and to collaborate daily more usefully for the progress of the world.

Discussion.

Col. T. F. Purves (Chief Engineer, G.P.O.) said he had known of M. Belin's invention for some time, but had had considerable difficulty in getting any particulars of it. He pointed out that, in France, M. Belin would have to compete with a very highly-developed system of telegraphy, so that the economics of the thing would demand very careful study. He expressed the hope that M. Belin would pay a visit to the Post Office and give them some information about his invention.

Major H. P. Lefroy referred to the transmission of shorthand, and said it seemed to him that that was the most revolutionary thing in telegraphy in England that M. Belin had mentioned from a practical point of view. In five minutes 1,453 words had been transmitted—nearly 300 words a minute. He supposed that that was not revolutionary, but it would probably be greatly exceeded in the future.

The Chairman recalled that, some years ago, when he had addressed the Röntgen Society, he had mentioned television, and had pointed out the great difficulties connected with it. He had had the temerity to show a diagram of an apparatus to do it with, but he had never actually made the apparatus. It ought to work, theoretically, but there was a great difference between theory and practice.

BRITISH ELECTRICAL AND ALLIED MANUFACTURERS' ASSOCIATION.

Dinner in Honour of the Prince of Wales.

On Thursday last week, at the Connaught Rooms, London, the British Electrical and Allied Manufacturers' Association gave a dinner, at which the principal guest was the Prince of Wales. Some 700 covers were laid, and the guests included distinguished representatives of science and engineering, industry and commerce, the Home and Dominion Governments, the Services, the British Empire Exhibition, &c.

The President of the Association, Lord Derby, K.G., occupied the chair, and was supported by the chairman, Mr. B. Longbottom, and members of Council. An interesting feature was the decoration of the tables solely with Dominion plants and fruit, under the supervision of Dr. A. W. Hill, F.R.S., director of the Royal Botanical Gardens, Kew.

After the toast of "The King," Mr. B. Longbottom read a number of messages of loyalty to the Prince and greeting to the members from branches of the Association in Australia, South Africa and India. Lord Derby then, proposing the health of the Queen and the Royal Family, specially welcomed the Prince of Wales as President of the British Empire Exhibition; his presence was a gracious acknowledgment of the work done by the Association in organising the Electrical Section of the Palace of Engineering, and the World Power Conference, at which 40 nations would be represented. They should all do their utmost to make the Exhibition a gigantic success.

The Prince of Wales, on rising to reply, was greeted with acclamation; he congratulated the B.E.A.M.A., and thanked the members for the great part they were taking in the Exhibition. Throughout the 19th century, he said, although British science had made remarkable progress, our manufacturers had hardly kept pace with it; we made discoveries and foreign countries exploited them. But all that was changed during the war, when British energy and enterprise brought this country into the first place in electrical science. They owed a great debt to the scientists, manufacturers, and workers who accomplished so much—the nation should never again fall behind in electrical development. The age of steam was passing away, and the age of electricity was dawning; let them maintain the lead in the latter as they had done in the former.

Proposing the toast of "Imperial Trade and Resources," the Prince said they should look at electrical development as it affected the whole Empire, which possessed enormous natural resources for the cheap production of electricity; in Canada there were limitless possibilities, and in far-off Tasmania a good start had been made. If Great Britain continued to progress in electrical work the Empire would lead in the age of electricity as in the age of steam.

Responding to the toast, Mr. L. S. Amery, M.P., First Lord of the Admiralty, referred to the atmosphere of electrical disturbance in the House of Commons, and asked whether trade was to be "free" or "fair"? preferential, or undiscriminating? Under the Union Jack were natural resources without limit, wealth beyond compute. The great human qualities of the British race revealed by and partly created by the Great War would convert the great resources of the Empire into wealth and happiness. The human and material resources of the Empire were unevenly divided—there were 14 million square miles of the richest country in the world, here were 50 million people huddled together in one small island; the great problem before our generation was how to marry the human capacities of our people to the boundless resources of our great heritage. They must set in motion the free emigration of the British race which had ever lain in their blood. They could not establish a man on the land or in any industry without the aid of capital; capital would not move unless there were some prospect of a fair return, and men would not migrate to a distant land unless they could see a market for their products. Men, money, and markets were the three essential factors that must come into play in the problem of Imperial development, by which alone prosperity could be restored to these islands. Communication was the groundwork of civilisation and trade; the British Empire existed to-day largely because of the submarine cable, and in the coming period of active development they needed the help of every form of communication. He had unlimited confidence in the future of the race, and claimed that the next generation would be the age of the British Empire.

Lord Derby, in proposing "Our Guests," referred especially to the presence of representatives of the great Dominions. Unfortunately the Prime Ministers of Australia and Newfoundland were unable to be present.

Sir Patrick McGrath, K.B.E., member of the Legislative Council of Newfoundland, responding, said that he had seen nothing in this country so inspiriting as that gathering, a manifestation of the bulldog determination of this country to maintain and improve its position in the world. The greatest exhibition in history was going to be a most complete success. In Newfoundland, in 15 years, British enterprise, capital, and prevision had turned a wilderness into a populous industrial area, producing 200 tons of paper a day; that output was to be increased by 50 per cent., and a new factory to produce 400 tons a day was to be established. Sir Charles Morgan, C.B.E., president Inst.C.E., also responded, referring to the wonderful work of the B.E.A.M.A. in keeping industry in our own hands, and keeping out the outsider; its efforts deserved every commendation.

Mr. B. Longbottom proposed "The Chairman," warmly expressing the pride of the Association in the presidency of Lord Derby, who had rendered great services to industry and commerce, and was a link between the political and industrial life of the country. The toast was accorded musical honours, and Lord Derby feelingly acknowledged the compliment.

The arrangements for the function were admirably made and efficiently carried out in all respects, marking a red letter day in the history of the B.E.A.M.A. The band of the Royal Engineers under Lieut. Neville Flux provided a programme of music during the dinner.

Amongst those present were Sir Charles Parsons, Mr. H. C. Levis, Sir Richard Glazebrook, Mr. Hugo Hirst, Sir H. Frank Heath, Mr. Godfrey Isaacs, Sir John Snell, Sir Joseph Petavel, Mr. E. Garcke, Sir James Stevenson, Sir Arch. Denny, Engineer Vice-Admiral R. B. Dixon, Col. R. K. Morcom, Dr. Alex. Russell, Sir Robert Hadfield, Sir Philip A. M. Nash, Mr. W. O. Smith, Sir John Dewrance, Sir George A. Touche, Sir James Devonshire, Mr. W. Rutherford, Mr. Ll. B. Atkinson, Col. T. F. Purves, Mr. C. H. Wordingham, Sir Harry Renwick, Mr. W. McClelland, and Mr. D. N. Dunlop.

Employment of the Press.—The extent to which the daily Press is used by the electrical industry of the United States was indicated in an article which recently appeared in *Electrical Merchandising*. The Society for Electrical Development has a special Press service by which matter of an electrical nature produced in a form likely to be acceptable to the general public is circulated once a week to 501 newspapers in the United States. These journals have a combined circulation of 11,356,877 copies per day, and, assuming that each paper is read by at least two people, it will be seen that the "electrical idea" is presented to close upon 23,000,000 people weekly. During the past year approximately 76,000 column inches appeared in American newspapers.

DEVELOPMENTS IN ILLUMINATING ENGINEERING.

Illuminating Engineering Society's Meeting.

The opening meeting of the Illuminating Engineering Society was held on November 13th, and was, as usual, devoted to reports of progress and exhibits of novelties in lighting.

Mr. Leon Gaster, who presided, briefly reviewed the chief events during the vacation, dwelling particularly on the continued growth of interest in industrial lighting. A feature had been the educational work of the Home Office Factory Department, working in co-operation with the chief Joint Industrial Councils, notably that concerned with the hosiery trade. Another instance was furnished by Mr. D. R. Wilson's popular address before representatives of the pottery industry, now published in pamphlet form. A very full report on industrial lighting had also been issued by the International Labour Bureau of the League of Nations, which would shortly be translated into English. A new edition of the illustrated pamphlet on "Good Lighting as an Aid to Safety," published by the British Industrial Safety First Association, was about to be issued, and the Department of Scientific and Industrial Research had recently appointed a Committee on Illumination, which would be able to deal with various outstanding problems.

All this illustrated the growth of interest in lighting, and there was a general recognition that the time was ripe for more widespread propaganda amongst the general public. Some of the leading firms in the lighting industry had shown enterprise in arranging demonstrations of good and bad methods of lighting. Naturally unity of effort was desirable, and it had been suggested that educational work of this kind should be under the supervision of a small committee of the Society, composed of members who were also associated with leading firms concerned with lamps and lighting appliances.

Following Mr. Gaster's address Mr. A. Cunnington gave an account of some of the tests that were being conducted on the chief railway systems with the object of determining the conditions of lighting that were desirable for station platforms, goods-yards, &c., and Mr. J. S. Dow then read the report presented by the Committee on Progress in Lamps and Lighting Appliances. It was stated that the year 1922-23 had seen a marked tendency towards co-operation by leading manufacturers, both in propaganda work and in efforts to attain standardisation of lamps and fittings. An instance of useful standardisation was afforded by the series of lamps for automobile headlights which would be stamped with the letters "B.A.S." (British Automobile Standard) and would meet the requirements of all British cars.

Other developments in lamps were illustrated by the demonstration given by Mr. L. E. Buckell, who showed some of the latest types for projector work, "daylight" lamps, and very large lamps consuming from 3 to 4 kW. The most interesting novelty, however, was the series of lamps that are sprayed —by a new process—with a solution of china-clay, giving an even white coating on the surface of the bulb, and resulting in a very soft and well-diffused light. The process was carried out on scientific lines, the material showed excellent wearing properties, and the absorption was estimated not to exceed 7 per cent.

Mr. E. Greetham demonstrated a new form of "pointolite" lamp, which could be used in alternating-current circuits. One of the chief limitations of this form of lamp had hitherto been that it could only be used on d.c. circuits, so that its applications should now be considerably extended.

Miss Beatrice Irwin gave an account of the principles underlying the Irwin colour filter system and exhibited a variety of diffusing cylinders of hand-painted parchment paper, in pleasing combinations of colour, which were considered to give a very soft and restful light, agreeable to the eye.

Capt. E. Stroud exhibited two Holophane fittings, equipped with a tinted screen within the glassware, whereby striking colour combinations could be produced. Such units were intended primarily for decorative purposes, for example, in kinema theatres.

An ingenious form of electric headlight for motor-cars, due to Mr. H. Workman, was next exhibited. This appeared to effect the desired limitation of the beam below a prescribed plane above the horizontal in a very simple manner and excited much interest.

Finally Mr. E. T. Ruthven Murray showed some new forms of the "Internalite" luminous sign, in which lettering or designs stencilled on a plate of clear glass were illuminated by concealed tubular lamps placed along the edge of the plate. Special interest attached to a new model giving a brightly-illuminated picture on both sides of the plate.

The proceedings were terminated by a vote of thanks to the exhibitors and the chairman, after which it was announced that the next meeting would be held on Tuesday, December 11th, when a paper on "The Application of Illuminating Engineering in Practice" would be read by Mr. G. Herbert and Mr. R. A. Ives.

NEW PATENTS APPLIED FOR, 1923.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Patent Agents.

The name of the applicant's patent agent, if any, will be found on the printed specification.

27,363. "Starting electric luminous discharge lamps and tungsten arc lamps." General Electric Co., Ltd. October 31st. (Germany, May 4th.)
27,370. "Electric light fittings." F. C. B. Chase. October 31st.
27,383. "Manufacture of adaptors for thermionic valves, &c." G. Barbe and T. Hough. November 1st.
27,391. "Electrodes for furnaces." H. Brearley. November 1st.
27,396. "Aerial for wireless receiving apparatus." W. B. Colbrook. November 1st.
27,400. "Electrically-operated counting, &c., mechanism." D. Carlaw and D. Carlaw & Sons, Ltd. November 1st.
27,420. "Electric signalling systems." J. Scott-Taggart. November 1st.
27,421. "Electric signalling systems." J. Scott-Taggart. November 1st.
27,422. "Electric signalling systems." J. Scott-Taggart. November 1st.
27,427. "Electric relays." B. H. Leeson, Nalder Bros. & Thompson, Ltd., F. H. Nalder, and A. Reyrolle & Co., Ltd. November 1st.
27,433. "Sparking plugs." A. E. Heath. November 1st.
27,444. "Sparking plugs." W. J. Atkins. November 1st.
27,446. "Inductance, &c., coils and formers therefor." E. C. W. Evans. November 1st.
27,463. "Rear lamps for vehicles." A. C. Riley. November 1st.
27,480. "Vacuum-tight sleeve insulators for leading electrodes through walls of metal vessels." Akt. Ges. Brown, Boveri et Cie. November 1st. (Germany, November 3rd, 1922.)
27,482. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). November 1st.
27,489. "Electric switching apparatus." Relay Automatic Telephone Co., Ltd., and G. E. Shklovsky. November 1st.
27,491. "Wireless systems." R. F. Drury. November 1st.
27,494. "Controlling electric circuits." E. B. Wilford. November 1st.
27,501. "Automatic switches for telephone systems." Automatic Telephone Manufacturing Co., Ltd., and J. Nixon. November 1st.
27,503. "Sparking plug." H. M. Harmer. November 1st.
27,505. "Crystal detectors." T. E. Betts. November 2nd.
27,506. "Tubular formers for windings of wireless telephony inductances." W. U. Pearson. November 2nd.
27,509. "Electric resistances." R. N. Dawson and F. K. Woodroffe. November 2nd.
27,522. "Wall boxes for electric switches, &c." E. T. Davies and Wandsworth Electrical Manufacturing Co., Ltd. November 2nd.
27,524. "Earphone carrier." W. A. Cartwright. November 2nd.
27,527. "Wireless valve plugs." L. A. Hackett. November 2nd.
27,529. "Device for letting down the mica on commutators of electric machines." J. H. Bennison and F. Pape. November 2nd.
27,534. "Head 'phones for telephony." C. S. Southin. November 2nd.
27,545. "Dry cells, &c." M. A. Adams and R. Baille. November 2nd.
27,548. "Anti-dazzle device for head lamps." F. Carter. November 2nd.
27,563. "Separators for electric storage batteries." Fuller's United Electric Works, Ltd., and W. L. Topple. November 2nd.
27,570. "Separators for electric storage batteries." L. Fuller and Fuller's United Electric Works, Ltd. November 2nd.
27,571. "Intervalve and telephone transformers for wireless circuits." Fuller's United Electric Works, Ltd., and A. P. Welch. November 2nd.
27,573. "Ventilation and cooling of electrical machines, &c." Metropolitan-Vickers Electrical Co., Ltd., and J. W. Young. November 2nd.
27,574. "Induction motors." W. A. Benger and F. & A. Parkinson, Ltd. November 2nd.
27,585. "Variable electric resistances." L. H. Wadsworth. November 2nd.
27,590. "Turntables for sound-reproducing, &c., machines." Columbia Gramophone Manufacturing Co. November 2nd.
27,597. "Electric switches." C. M. Page. November 2nd.
27,600. "Lighting apparatus." F. E. Metcalfe. November 2nd.
27,608. "Incandescent electric lamps." E. R. Grote. November 2nd.
27,609. "Three-phase rivet heater." Soc. Anon. Electricité Electromécanique. November 2nd. (Belgium, April 11th.)
27,612. "Safety devices for electric networks, &c." Soc. Anon. Lutèce-Lumière. November 2nd. (France, December 20th, 1922.)
27,635. "Standards, &c., for electric light, &c., fittings." H. J. C. Forrester (G. Borgfeldt & Co.). November 3rd.
27,644. "Trolley, &c., shoes for electric traction." S. Collinson and F. Coultas. November 3rd.
27,650. "Anti-dazzle devices for motor vehicles." T. Cheetham. November 3rd.
27,661. "Electric fuses." Electrical Improvements, Ltd., and G. L. Porter. November 3rd.
27,667. "Mine-signalling apparatus." G. Adam and J. Adam (executor of J. Adam). November 3rd.
27,672. "Single-phase alternating-current motors." V. Ferrari and C. Fontana. November 3rd.
27,673. "Electric sub-stations." R. C. Minton and A. Reyrolle & Co., Ltd. November 3rd.
27,681. "Portable electric lamp standards." British Thomson-Houston Co., Ltd., and H. C. Wheat. November 3rd.
27,692. "Devices for production and amplification of electrical oscillations for telegraphy, &c." A. R. Angus. November 3rd.
27,693. "Devices for production and amplification of electrical oscillations for telegraphy, &c." A. R. Angus. November 3rd.
27,694. "Means for truing up tires of tramways, &c., wheels." F. C. Muirhead. November 5th.
27,698. "Commutator for motor-car ignition systems." S. G. Pickering. November 5th.
27,703. "Electric generating systems of motor vehicles." Brolt, Ltd., and W. Holt. November 5th.
27,730. "High-frequency amplifiers for wireless apparatus." H. G. B. Corby, F. C. R. Holland, and A. E. Katz. November 5th.
27,733. "Electric switches." E. Bolton. November 5th.
27,735. "Filament rheostats for valves for wireless telephony, &c." W. C. Davey and G. Wallace. November 5th.
27,736. "Measuring electricity." H. Cooch. November 5th.
27,744. "Electric lighting for motor vehicles, &c." P. R. Ord. November 5th.
27,760. "Electric water-heating apparatus, &c." K. F. Henneman and P. Kerkhoven. November 5th. (Holland, November 7th, 1922.)
27,779. "Stands for electric heaters, &c." G. H. Collins and H. F. Collins. November 5th.
27,786. "Electric switches." Lissen, Ltd., and R. P. Richardson. November 5th.
27,787. "Electric condenser." Lissen, Ltd., and R. P. Richardson. November 5th.
27,789. "Telephones, &c." M. R. Lawrance and Sterling Telephone and Electric Co., Ltd. November 5th.
27,790. "Electric alarm apparatus, &c." D. Müller and H. Thirring. November 5th. (Austria, November 11th, 1922.)
27,794. "Illuminated signs." E. E. Stockwell. November 5th.

27,796. "Telegraphic transmitting, receiving, and printing apparatus." F. G. Creed and Creed & Co., Ltd. November 5th.
27,797. "Electric interrupters, &c." W. Hancock and T. P. Middleton. November 5th.
27,[illegible]. "Cooling dynamo-electric machines." British Thomson-Houston Co., Ltd., and A. A. Pollock. November 5th.
27,800. "Shaft setting arrangement for electric switches, &c." H. Baron (F. Aldendorff). November 5th.
27,818. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. November 5th. (United States, March 19th.)
27,819. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. November 5th. (United States, April 9th.)
27,830. "Means for preventing dazzling effect of headlights." W. Ellis. November 6th.
27,845. "Crystal detectors." H. J. Everill. November 6th.
27,849. "Indicating-devices for electric heating apparatus." H. E. Angold. November 6th.
27,883. "Telephone systems." Western Electric Co., Ltd. (Western Electric Co. Inc.). November 6th.
27,866. "Electric water-heaters." J. A. MacDonald. November 6th.
27,876. "Apparatus for electrical precipitation of suspended particles from gaseous fluids." Lodge-Cottrell, Ltd. (Metallbank und Metallurgische Ges.). November 6th.
27,877. "High-voltage insulator for electric gas purifiers, &c." Lodge-Cottrell, Ltd. (Metallbank und Metallurgische Ges.). November 6th.
27,890. "Electric resistances." E. L. Conradi. November 6th.
27,900. "Electric heaters." B. Thomas and E. Thomas. November 6th.
27,904. "Electric condensers." R. L. Randall, C. Seymour, and W. Ure. November 6th.
27,913. "Telephone systems." R. Mercer. November 6th.
27,914. "Wireless receiving apparatus." F. R. Johnston. November 6th.
27,922. "X-ray photography." A. G. Bloxam (Akt. Ges. für Anilin-Fabrikation). November 6th.
27,928. "Electricity meters." Chamberlain & Hookham, Ltd., and S. James. November 6th.
27,933. "Electric switches." Akt. Ges. Brown, Boveri et Cie. November 6th. (Germany, November 6th, 1922.)
27,936. "Brush mounting for electric motors." P. T. King. November 6th.
27,938. "Dynamo-electric machines." J. A. Kuyser and Metropolitan-Vickers Electrical Co., Ltd. November 6th.
27,939. "Dynamo-electric machines." G. H. Fletcher and Metropolitan-Vickers Electrical Co., Ltd. November 6th.
27,940. "Crystal detectors." R. R. Myras. November 6th.
27,950. "Circuit arrangement employing thermionic valves." British Thomson-Houston Co., Ltd. November 6th. (United States, November 9th, 1922.)
27,953. "Variable condensers." L. A. Hammarlund. November 6th. (United States, November 28th, 1922.)
27,962. "Electric lamps." E. T. Williams. November 6th.
27,997. "Apparatus for teaching telegraphy." P. E. Cheesman. November 7th.
27,999. "Automatic Morse transmitter." P. J. Browne. November 7th.
28,001. "Telephone receivers, &c." L. G. Toplis. November 7th.
28,013. "Receivers for telegraphy, &c." G. Green and A. J. Younger. November 7th.
28,023. "Connection of electrical apparatus in circuits." W. H. Matthews. November 7th.
28,028. "Vernier control device for variable condensers, &c." L. E. Fillmore and L. W. C. Fillmore. November 7th.
28,030. "Electric generators." W. J. Polyblank. November 7th.
28,036. "Electric coils for wireless telegraphy, &c." J. Henderson. November 7th.
28,044. "Induction motors." A. G. Goddard and J. Lyons & Co., Ltd. November 7th.
28,045. "Wireless receiving apparatus." W. S. Flight, Igranic Electric Co., Ltd., and A. H. Mackley. November 7th.
28,048. "Coil-holder for wireless signalling systems." A. H. Curtis, Igranic Electric Co., Ltd., A. H. Mackley, and S. R. Wright. November 7th.
28,049. "Frames, &c., for electrical apparatus." H. G. Bell and Metropolitan-Vickers Electrical Co., Ltd. November 7th.
28,053. "Means for eliminating disturbing electric oscillations." Ges. für Drahtlose Telegraphie. November 7th. (Germany, November 8th, 1922.)
28,058. "Remote-control systems." R. C. Arter. November 7th.
28,063. "Wireless reception apparatus." J. Atherstone, R. S. Atherstone, F. H. Brewerton, and L. Brewerton. November 7th.
28,067. "Devices for counting electrical or mechanical impulses." M. B. Richter. November 7th.
28,079. "Tapping switches for high-voltage transformers." Akt. Ges. Brown, Boveri et Cie. November 7th. (Germany, November 13th, 1922.)
28,080. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. November 7th. (United States, July 6th, 1922.)
28,093. "Electrical machinery for immersion in liquids, gases, &c." H. G. Cameron. November 8th.
28,097. "Anti-dazzle devices for motor-vehicle headlights." J. C. Hancock. November 8th.
28,101. "Electric batteries for wireless installations." W. A. G. Burton. November 8th.
28,103. "Wireless receiving apparatus." F. Milborne. November 8th.
28,105. "Variometer for wireless telegraphy, &c." B. Groom. November 8th.
28,115. "Distribution of electric ignition systems for automobiles, &c." F. W. Baker. November 8th.
28,120. "Trolley heads for electric traction." A. Muir and Unity Engineering and Chemical Co., Ltd. November 8th.
28,122. "Wireless telephone receivers." S. Timings. November 8th.
28,129. "Coil-holder stands for wireless apparatus." J. E. Dawson. November 8th.
28,130. "Panel boards for wireless signalling, &c., apparatus." R. E. Beswick and Radio Communication Co., Ltd. November 8th.
28,131. "Panel boards for wireless signalling, &c., apparatus." R. E. Beswick and Radio Communication Co., Ltd. November 8th.
28,132. "Casings for sectional panel boards, &c." R. E. Beswick and Radio Communication Co., Ltd. November 8th.
28,141. "Rheostat for wireless sets." A. S. Marks. November 8th.
28,148. "Means for control of electric motors, &c." L. Murphy. November 8th.
28,159. "Means for protection of dynamo-electric machines." Siemens and Halske Akt. Ges. November 8th. (Germany, November 8th, 1922.)
28,168. "High-frequency electric protection device." Ferranti, Ltd., and E. D. T. Norris. November 8th.
28,173. "Electric lamps." R. Lomax. November 8th.
28,189. "Device for adjustment of magneto contact breaker." C. Grimshawe. November 8th.
28,195. "Crystal detectors." A. H. Hunt. November 8th.
28,201. "Appliance for connecting electric wires to terminals." W. Brewer. November 9th.
28,203. "Electric power transmission systems." A. M. Taylor. November 9th.
28,212. "Electric condensers." T. Hough and W. J. Joughin. November 9th.
28,214. "Crystal holders for wireless telephone reception." E. Johnson. November 9th.
28,215. "High-frequency transformers for wireless telegraphy, &c." B. Hesketh. November 9th.
28,216. "Induction coil holders." B. Hesketh. November 9th.
28,217. "Crystal detectors." B. Hesketh. November 9th.
28,227. "Telegraph, &c., insulators." S. W. Richards. November 9th.
28,247. "Coil-holder for wireless telegraphy, &c." G. Turner. November 9th.
28,263. "Electric switches." Fabrik Elektrischer Apparate F. Sauter Akt. Ges. November 9th. (Germany, November 10th, 1922.)
28,265. "Vacuum electric tubes." E. Y. Robinson. November 9th.
28,275. "Electrical connections." A. J. Bull and F. W. Bull. November 9th.
28,277. "Means for controlling charging of batteries." Eclairage des Véhicules sur Rail. November 9th. (France, November 9th, 1922.)
28,280. "Electrical thawing of carcasses of frozen meat, &c." A. A. Alcock. November 9th.
28,282. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. November 9th. (United States, December 23rd, 1922.)
28,284. "Electricity meters." F. Holden and Measurement, Ltd. November 9th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1922.

11,307. "Signalling system, especially radio-communication." J. Scott-Taggart. April 22nd, 1922. (Cognate application 13,945/22.) (205,837.)
14,713. "Means for receiving alternating-current electrical signals." F. E. Pernot. May 25th, 1922. (205,843.)
14,844. "Means for controlling the ignition lever of an internal-combustion engine." J. L. Brunton and W. P. Brunton. May 26th, 1922. (205,844.)
19,907. "Automatic or semi-automatic telephone systems." Relay Automatic Telephone Co., Ltd., and W. D. Edwards. July 20th, 1922. (205,861.)
20,039. "Telephone exchange systems." Coventry Automatic Telephones, Ltd. (F. R. McBerty and R. C. Arter). July 21st, 1922. (205,864.)
20,123. "Alternating-current protective apparatus." British Thomson-Houston Co., Ltd., and A. S. Fitzgerald. July 22nd, 1922. (205,866.)
20,337. "Method of, and means for, signalling or modulating by grid potential control in thermionic valve circuits for wireless telegraphy or telephony." L. G. Preston, G. Shearing, and G. A. Irving. July 25th, 1922. (205,878.)
20,350. "Electrode structure and method of manufacturing same." J. P. Scott. July 25th, 1922. (205,883.)
20,352. "Electrolytic cells." J. P. Scott. July 25th, 1922. (205,884.)
20,361. "Means for interconnecting electrical lines, particularly in telephone plants." Relay Automatic Telephone Co., Ltd. October 15th, 1921. (187,580.)
20,369. "Jewel bearings for the rotary elements of electric meters." G. A. Cheetham, W. Smethurst, and Metropolitan-Vickers Electrical Co., Ltd. July 25th, 1922. (205,886.)
20,372. "Bituminous concrete pavements and method of making same." W. J. Mellersh-Jackson (W. E. Hacker). July 25th, 1922. (205,887.)
20,393. "Rectifying commutators for charging accumulators by alternating current." J. H. Bregi. July 26th, 1922. (205,889.)
20,452. "Dynamos for train lighting and similar installations." J. Stone and Co., Ltd., and A. H. Darker. July 26th, 1922. (205,891.)
20,476. "Contacts for electric relays, keys, and the like." F. R. McBerty. August 10th, 1921. (184,438.)
20,555. "Mechanism such as is applicable to impulse-sending devices for automatic telephone systems." A. F. Wood, W. Stott, and Telephone Manufacturing Co., Ltd. July 27th, 1922. (205,897.)
20,563. "Protective arrangements for alternating electric current circuits." A. Reyrolle & Co., Ltd., and R. W. Biles. July 27th, 1922. (205,899.)
20,574. "High-frequency signalling systems." British Thomson-Houston Co., Ltd. July 27th, 1921. (183,838.)
21,373. "Control of electric motors driving planing and like machines." British Thomson-Houston Co., Ltd., R. D. Given, and C. J. H. Trutch. August 4th, 1922. (205,921.)
21,683. "Submarine cable telegraph systems." Western Electric Co., Ltd. (Western Electric Co., Inc.) August 9th, 1922. (205,928.)
21,721. "Electrical joint boxes." C. J. Baker and E. R. Ingram. August 9th, 1922. (205,929.)
21,789. "Terminals for electrical work." A. Rothschild. May 10th, 1923. (205,930.)
22,054. "Ring-hand grip for railway and tramway vehicles and the like." P. Whittingham. August 14th, 1922. (205,934.)
22,532. "Electric cooking or heating devices." C. C. Armstrong. August 18th, 1922. (205,939.)
22,836. "Alternating-current dynamo-electric machines adapted for synchronous working." L. J. Hunt and Sandycroft, Ltd. August 22nd, 1922. (205,942.)
23,115. "Electrical instrument cases." Crompton & Co., Ltd., and W. G. Smith. August 25th, 1922. (205,944.)
23,157. "Method of, and apparatus for, producing and reproducing announcements, more especially the text and pictures of advertisements." F. J. Hering. August 27th, 1921. (185,128.)
23,928. "Electric transformers." A. E. L. Scanes and Metropolitan-Vickers Electrical Co., Ltd. September 4th, 1922. (205,948.)
24,003. "Anti-dazzle means for the headlights of motor vehicles." P. H. Evans. September 5th, 1922. (205,949.)
25,735. "Stands for electric irons." R. Jenkins. September 23rd, 1922. (205,961.)
25,787. "Fuse boxes and connections." A. Chalmers and W. F. Mitchell. September 23rd, 1922. (205,963.)
26,682. "Axles for electrically-driven road vehicles." H. M. Butler. October 3rd, 1922. (205,975.)
32,845. "Electric transformers and circuits therefor." Western Electric Co., Ltd. August 8th, 1922. (202,262.)
33,784. "Speed-controlling devices for railway and tramway trains." E. Rodolausse. December 11th, 1922. (Addition to 162,617.) (206,040.)
34,045. "Electric heating devices." C. G. Nobbs and W. W. Nobbs. December 13th, 1922. (206,041.)
34,900. "Automatic reclosing of electric circuit-breaker systems." British Thomson-Houston Co., Ltd. (General Electric Co.). December 21st, 1922. (206,042.)

1923.

1,715. "Electromedical appliance." R. A. Redmond. January 19th, 1923. (206,053.)
2,692. "Electric table, wall, or like lamps." O. & W. Bohnert (firm of). January 26th, 1922. (192,388.)
4,393. "Electric-circuit controlling devices." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). February 14th, 1923. (206,070.)
5,557. "Antennæ for wireless signalling." W. Dornig. November 30th, 1922. (Dividend application on 194,365.) (206,074.)
5,934. "Electrical junction boxes." D. Harvie and D. Harvie. March 1st, 1923. (206,078.)
6,206. "Adjustable lampshade holder for electric, gas, and oil lamps, or the like." F. G. Parks. March 3rd, 1923. (206,080.)
6,240. "Electric discharge devices." Western Electric Co., Ltd. (Western Electric Co., Inc.). March 3rd, 1923. (206,081.)
8,577. "Railway and tramway vehicles." C. T. Westlake. March 20th, 1923. (206,089.)
10,267. "Storage batteries." F. J. West. April 10th, 1923. (206,094.)
15,181. "High resistances for grid leaks, as used in wireless telegraphy and telephony apparatus and the like." A. E. Watkins. June 11th, 1923. (206,098.)